THE GRID

HOW RELEVANT IS IT TODAY?

A Thesis presented for a
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by

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THE GRID : How Relevant is it today?

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DEDICATION

To my family.

In memory of my grandmother and my brother Mustapha.

To Glasgow my love; the city from which we can learn a lot.

ACKNOWLEDGEMENTS

I owe my thanks to many people for their help and assistance to make this work possible.

- The Algerian Government for sponsoring me in my three years training.
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- Professor A. MacMillan for giving up his valuable time for discussion and providing me with material.
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INTRODUCTION AND SUMMARY

The aim of this dissertation is to examine the relevance of the grid today. The grid, "oldest known urban regulator" (1), has been the most important urban feature for many of our cities. It has not been a natural or arbitary gesture but a human decision to achieve certain goals and to satisfy certain needs. This makes the difference between a grid city and a non grid city. The grid city was planned and developed according to pre-determinated means.

Changes occurred on Societies and were reflected on the urban environment. Because the most dramatic changes occurred after cities' urban patterns had been laid out; their original efficiency has been reduced and could no longer cope with the new pressures. However, this work is an attempt to examine the relevance of the grid for today in both cases: existing and new situations.

The grid, as an intellectual device with long tradition in the art of city design, has been chosen by the speculator, the pioneer, the military man and the colonial to develop urban settlement. The first chapter is an historical examination to understand how and why the grid was used as space control development. It also gives an idea about the spirit of the age in which a grid was adopted. A typical example from each historical period illustrates the philosophy of urban planning and gives the reasons which dictated the use of the grid layout and its advantages. By this historical analysis, I find out

whether there has been continuity throughout the history of the grid in using the same reasons. At the end of this chapter there is a summary of the advantages for using the grid and their relevance for today.

The second chapter is an attempt to examine the relevance of the grid for today based on comparative analysis between three nineteenth century grid developments: Barcelona, in the South of Europe, Glasgow in the North and Chicago in America. The three cities were great commercial and industrial centres where changes of the last century occurred and affected strongly the grid pattern. By examining them, suggestions will be made to the problems arisen and affecting the grid's efficiency. A fourth city - Milton Keynes - which represents the latest grid development will be examined in order to show whether its plan has recognized these changes, was a response to what makes the existing cities do not work and how it did take into consideration these problems.

The third chapter is an Urban design analysis which examines the urban qualities of the grid. The grid has been challenged and criticized for its urban fabric. Glasgow would be a unique example of argue with due to its interesting townscape.

Finally, this piece of work ends by recommendations which should characterize a relevant grid especially for a future development. There will be also some proposals in urban design in an attempt to solve some of the gaps of the grid in existing cities.

REFERENCE

Introduction

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George Godwin Ltd., London, 1972

CHAPTER I : H I S T O R I C A L E X A M I N A T I O N

How and Why the Grid was Used?

CHAPTER I : HISTORICAL EXAMINATION

How and why the grid was used?

1. Classical

1a. The Greek Town of Miletus

Historically, the image of the city had been characterized by tribal concept until the Greeks changed it from a symbol of ethnic concept to a symbol of a political nation. This new concept was expressed in the unity of place and action(1) The Greek city's organization was based on social and economic life and its part were designed to function within the whole. As a result, the city state was clearly defined by its limits, its compact urban form and its integral social life.

Many factors determined the character of the Greek city: its situation, orientation, size and spatial configuration. The location determined the territorial organization from which resulted a clearly defined city and the whole layout responded to the climate by avoiding prevailing wind. The size of the city depended on the balance between the city's population and its surrounding area which supported its food production. As the city grew, a new settlement was found elsewhere to accommodate the new growth.

The Greek towns were mostly colonial in type. Their most important urban feature was the grid-iron layout. The grid-iron layout is simply defined as a set of parallel streets crossed by another set of parallel streets at right angles. The Greek used the grid-iron layout as a symbol of social democracy. This

democracy was highlightened in the meeting place - The Agora - where political and social debates took place and citizens had the right to discuss the affairs of their city. However, the main objective behind the choice of the grid-iron was no more than a gesture towards social democracy, being subserviant to the main reason of an equality in land-subdivision and public accessibility. The grid's ability to allow for rapid development is another advantage because the military planning required a quick development for self-defence and controlof the surrounding.

Miletus

Hippodamus, the great Greek architect and planner, adopted the grid-iron layout for Miletus which played a very important role as a commercial and military power and was a very famous and independent city in the Greek world.

The plan (Fig. 1) executed between 475 - 470 BC (2) occupied the whole of peninsular and was based on the grid-iron pattern broken in the central area where all public buildings and open spaces were located. The area within the defence walls was about 220 acres with the maximum dimension along and across the plan of 1960 yards/1842 metres and 1200 yards/1128 metres. The Agora (Fig. 2) centrally located, articulated three residential districts: two in the north and one in the southern part. At its west, were located the public buildings: gymnasium and the stadium and along all side the harbour. The three residential districts, The only area laid out on the grid-iron pattern, were differentiated by the size of the plot. In the southern part, the plots were

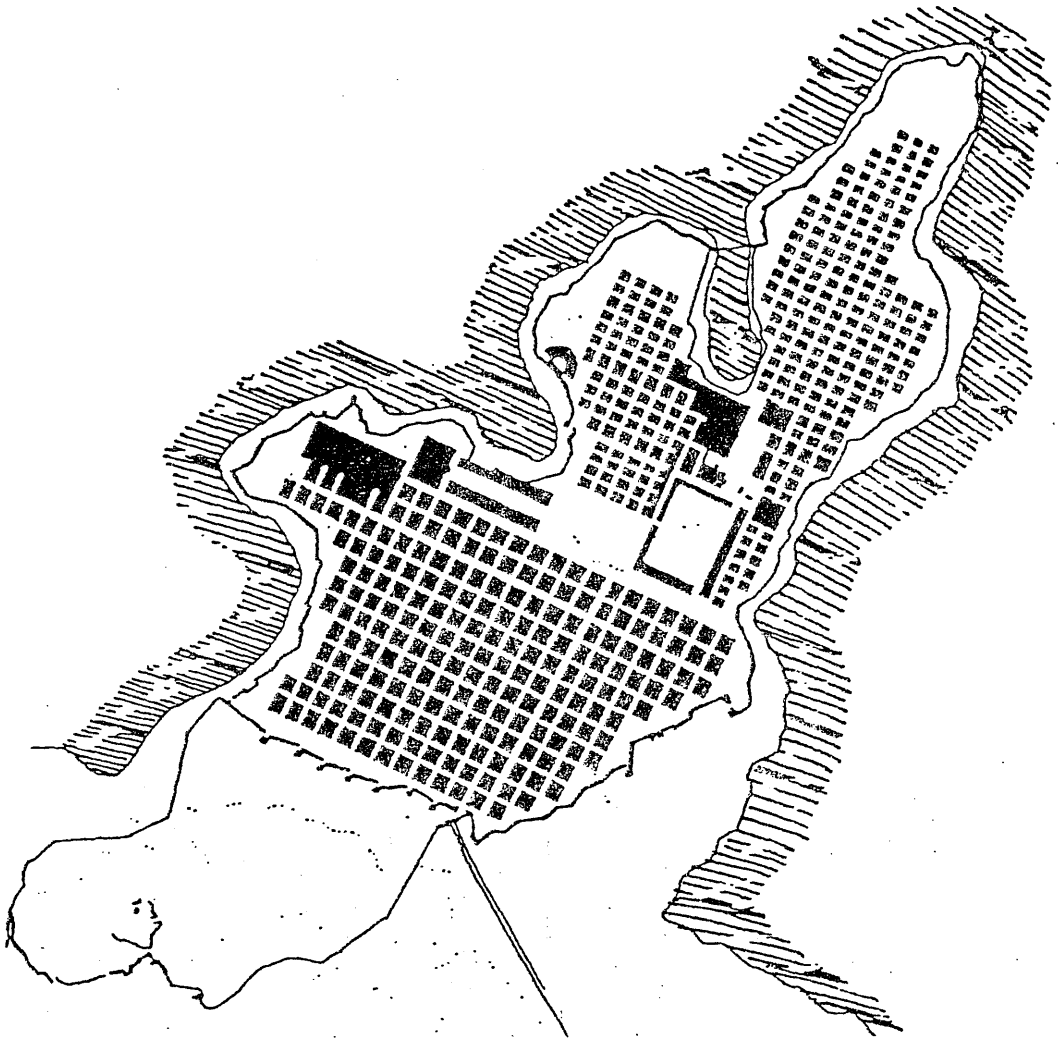

Fig. 1: Miletus, the general plan. 1:15000

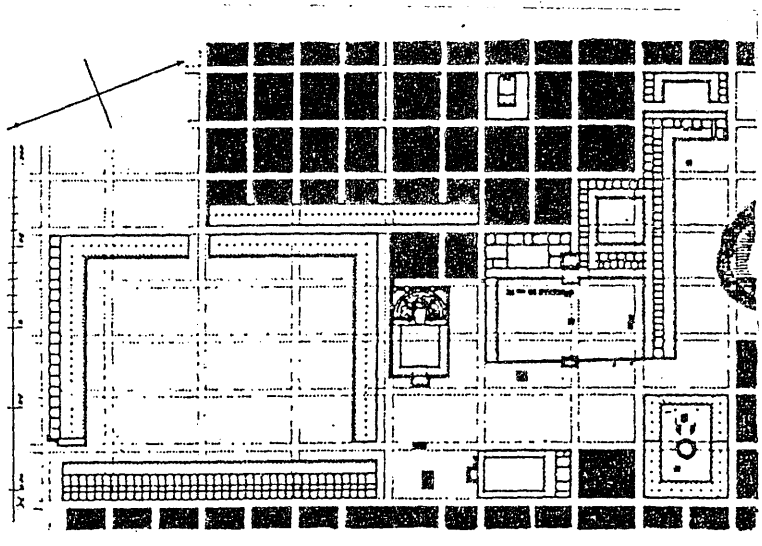

Fig. 2: Miletus, detail plan of the Agora.

bigger than the ones in the northern part. The difference in size, probably, corresponded to the social hierarchy (different groups of citizens and different groups of plots). The blocks enclosed courtyards which were the transition spaces between the public space (street) and the private space (house).

In the southern district, there were two cross-axes streets wider than most (8 yards/7.50 metres). This hierarchy of traffic was to improve circulation and break the uniformity of the spaces between blocks. The Hippodamian scheme, resulted from the grid-iron layout is,

> "in its essence derives from a system of parallel blocks with streets in one direction only, intersected by minor alleys at right angles." (3)

Miletus was a fine example of town which " shows how it is possible to develop forms of tremendously dynamic quality as contre-point to the rigid discipline of the grid plan" (4). The Greek urban design concept suggested that the overall aesthetic effects of town design were expressed in the design of the most commanding individual elements (public building and the Agora).

Advantages for using the grid by the Greeks were:

1. Ability to achieve equality in land sub-division and public accessibility.
2. Ability to allow for rapid development.
3. Ability to allow efficiency in servicing the town.

CHAPTER I : HISTORICAL EXAMINATION

Why and how the grid was used?

1. Classical

1b. The Roman Town of Timgad

The expansion of the Roman Empire resulted in the colonisation of its conquered territories. Towns played an important role in this colonisation procedure and appeared to respond to two main objectives: the control of resources and the relief of over population at home (5). This was achieved by the safe and efficient movement of goods and the inambiguous allocation of land and property. It was therefore important that the towns were developed as quickly as possible.

Colonial Roman plans were conceived in the manner of the "Centuriation" (Fig. 3) by which sections of land were divided into units based on the circumferences which an ox could plough in one day (6). The land was subdivided into lots - after being surveyed - and distributed amongst the soldiers of a "Centuria" (a company of one hundred soldiers) This ensured an equality of land sub-division as well as means of traffic distrubution movement. The overall plan was a grid-iron which was structed by two main axes: the "Decamanus" and the "Cardo" which met at right angles. The "Decamanus" ran parallely to the long side and the "Cardo" was the shorter. Their intersection was considered to be the ideal centre of the colony and developed as a formal space where most public buildings were grouped. The secondary streets, which crossed the two main axes at right angles, formed the grid-iron layout. Its uniformity and centralisation offered a compact

urban form and enclosure which contrasted sharply from its surroundings. The townscape contained many rich symbols of home in an attempt to highlight Rome's power and to create a home ambiance.

Timgad

Timgad, described by Lewis Mumford as "an example of the Roman planning art in all its latter-day graces" (7), is situated in the north-east of Algeria. It was a small town found by Targan in 100 AD (8) as a Roman colony, and built over a relatively short period. Initially, it was almost square in plan whose edges measured 300 yeards/357 metres and enclosed an area of 30 acres. (9) Topography was not a major determinant factor since the chosen site was flat. It was surrounded by defencible walls which were penetrated by four gates. The plan (Fig. 4) was laid out on the grid-iron pattern with the "Decamanus" and the "Cardo" meeting at the Central forum; these two elements formed the basic framework. Eleven secondary streets, running in each direction, crossed the main axes at right angle and formed the grid-iron plan. The layout was "the most regular example of imperial grid-iron based on urban planning" (10). The two main axes were ordered by columns, well paved and drained and ended in the central area where the forum, the theatre and other public buildings were located. Important public buildings were designed in such a way as to be identifiable through being distinguished style; they also broke the regularity of the grid. The residential blocks measuring between 70 x 70 feet/21 x 21 m^2 and 150 x 150 feet/45 x 45 m^2

enclosed courtyards which acted as links between public space (street) and private space (house).

Timgad contained a wide range of facilities designed and located in such a way to ensure a successful townscape. Facilities included arched walks, the forum, the theatre, the arena, the baths and public lavatories (Fig. 5).

Roman planning was basically military in character and was designed on the grid-iron.

The advantages for using it were:

1. Ability to allow for rapid development.
2. Ability to achieve an equality in land sub-division and public accessibility.
3. Ability to provide for easy troop movement.
4. Ability to police the town.
5. Ability to provide efficiency in servicing for the town.

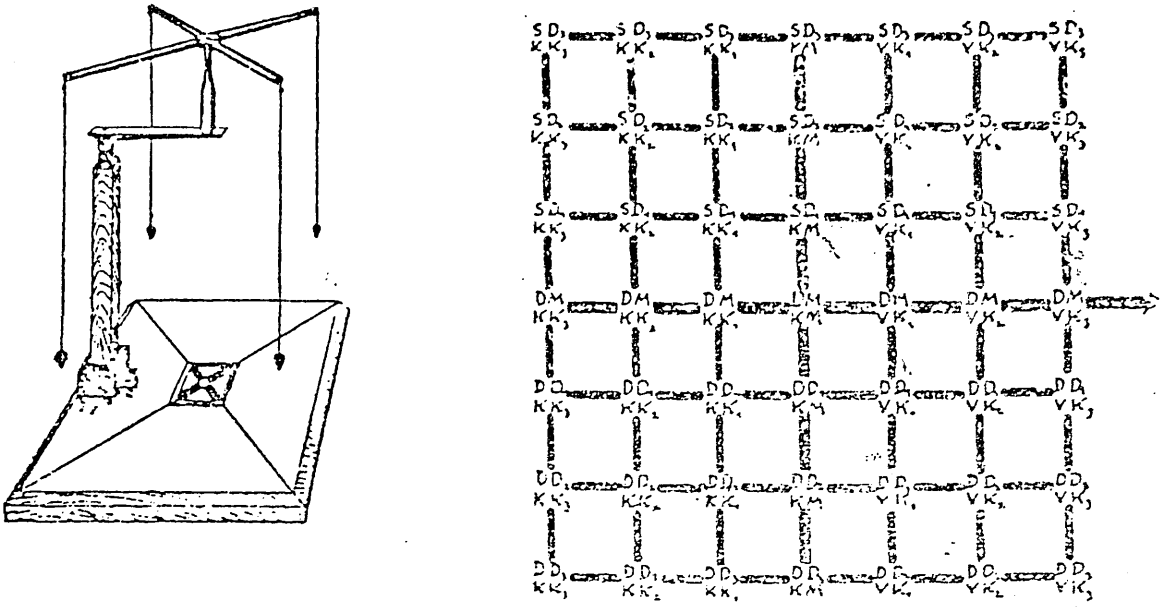

Fig. 4: Surveyor's instrument and "Centuriation"

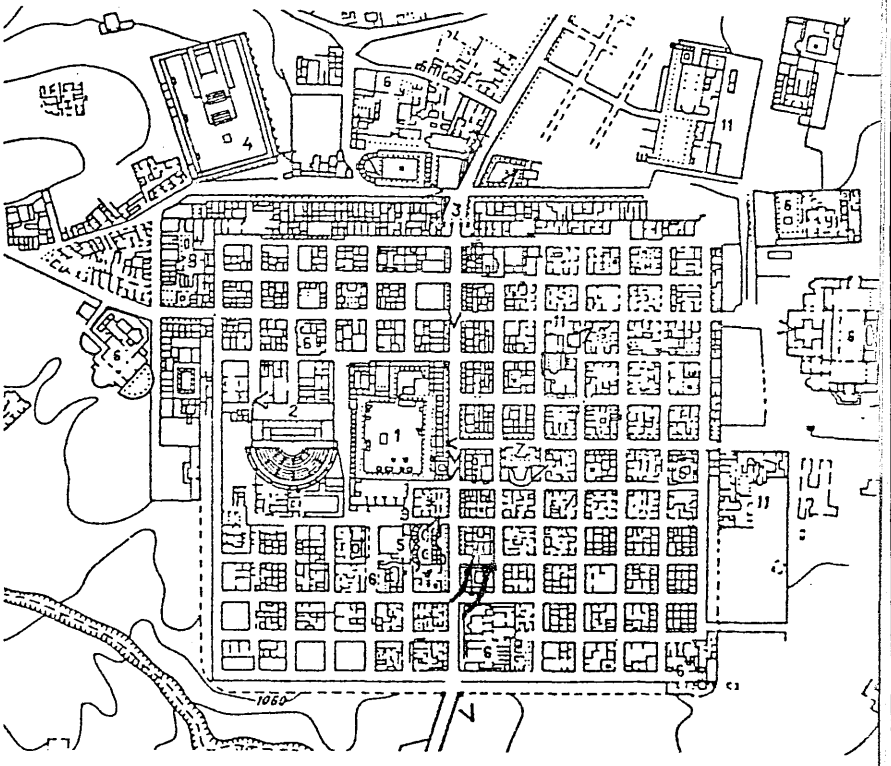

Fig. 4: Timgad

The general plan

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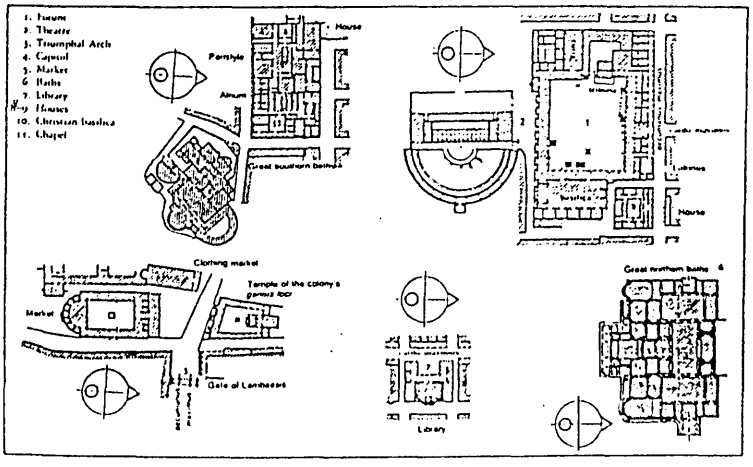

Fig. 5: Timgad. Urban facilities

CHAPTER I : HISTORICAL EXAMINATION

Why and how the grid was used?

2. Medieval Town : Aigues-Mortes

The beginning of medieval period was marked by the decline of the Roman Empire. Cities shrank in size and importance; economic and social confusion followed. Later the feudal system developed a market by a return to the importance of towns resulting in a new marked revival in trade.

The medieval town was usually dominated by the church or monastry and the feudal Lord's castle. The town's function was primarily for military security and trade protection. As a result they were situated on strategic hilly sites, surrounded by defensible walls which were penetrated by guarded gates. The church square and the market place were the centre of the town; the town hall and guild hall were built nearby. Main roads ran between the centre and the gates with a secondary network connecting them. The minor streets were used for pedestrian circulation within the town and wheeled traffic was generally absent on all but the main streets. Planning in this period fell into four categories:

1. The development of existing Roman towns, the street pattern was preserved and reconstructed.
2. The development of town around castles, monasteries or religious buildings (churches, cathedrals).
3. The development of strategic trading posts at cross-roads or fords near rivers and harbours.

4. The development of completely new colonial foundations for military and commercial purposes (security and protection).

The bastides towns were examples of the fourth category and were laid out on a regular pattern (grid), which was clear contrast to the normal irregular and informal medieval towns. The use of the grid was dictated by military and social reasons. The grid system allowed for easy and rapid development and offered the ability to police the town. The straight streets offered an easy access for troup movement. The grid system also allowed for social equality since it gives everybody the same right in land sub-division and distribution and access to public spaces.

Aigues-Mortes

The most famous medieval grid towns were developed by the English, the French (Fig. 6) and the Welsh. Among these, Aigues-Mortes, in the South of France, has been presented as an ideal bastide which was conceived as a whole and developed over a half century. It was founded by the King of France, Louis IX in 1240 as a base and gathering point to his crusades in the Holyland (11) In the same spirit, Edward I of England founded Monpazier in 1284 to protect his territory from French attack (Fig. 7)

Aigues-Mortes (Fig. 8) was rectangular in shape (650 x 300y - 630 x 290 m) and surrounded by a wall with circular double towers and pierced by five large gates. Each corner was occupied by a round tower including the tower of Constance (90 feet - 27.5 metre). Inside the wall, the town was laid out on a slightly distorted

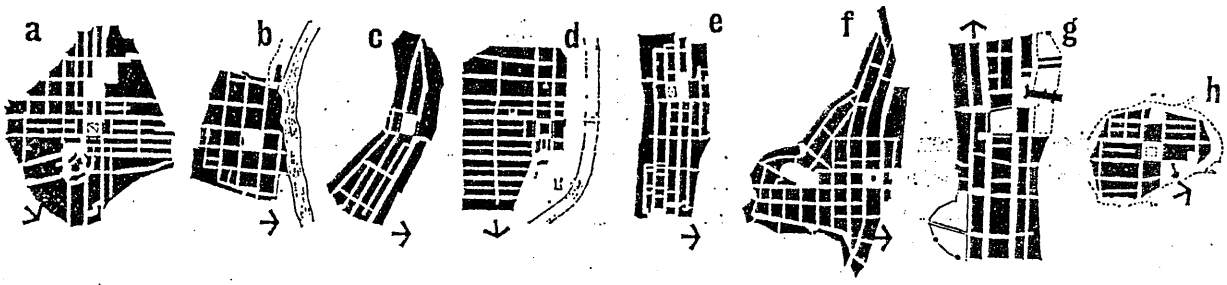

Fig. 6: French bastides

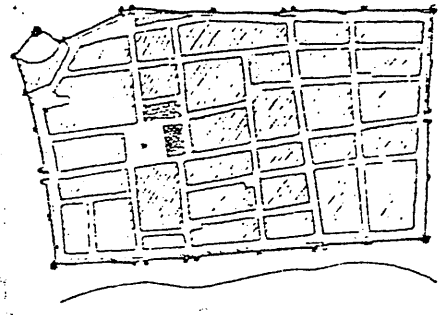

Fig. 8: Aigues-Mortes 1240

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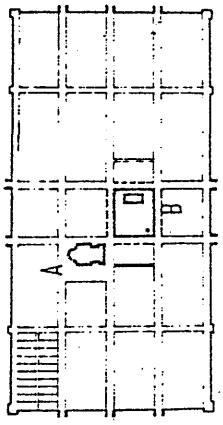


Fig. 7: Monpazier 1284

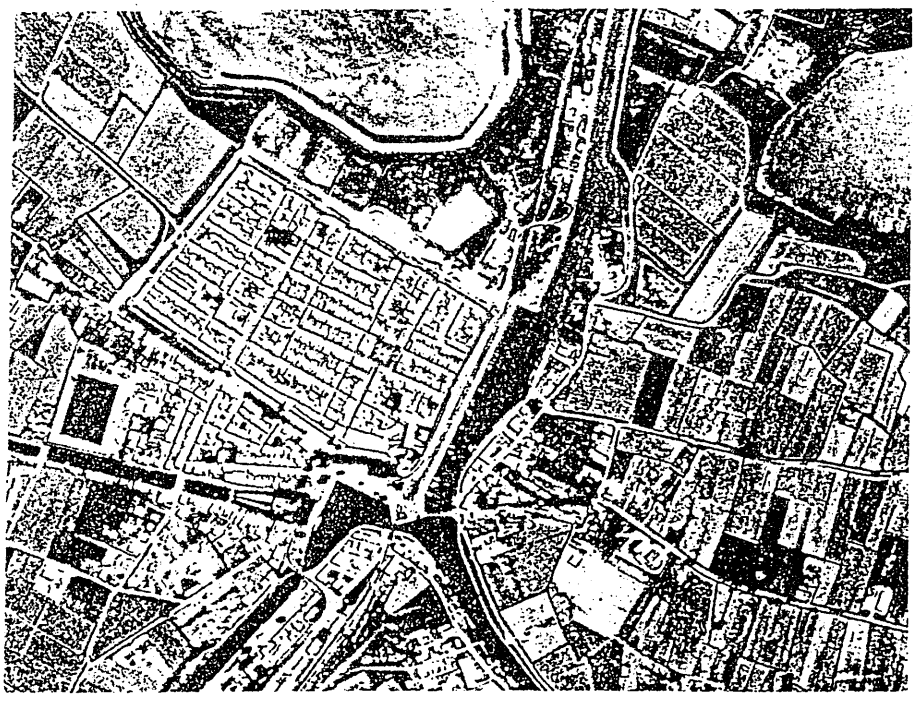


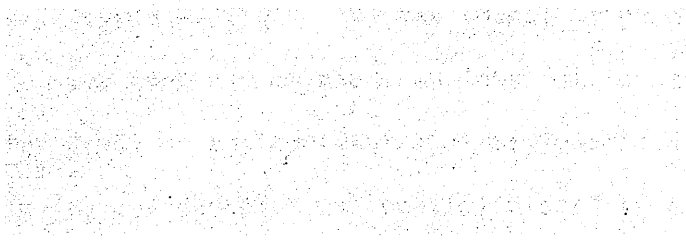
Fig. 8: Aerial view of Aigues-Mortes.

grid-iron. Main streets ran between the main square, which was situation near the western end of the town and the gates. Other streets ran parallel to the main streets and across them forming the whole grid-iron layout. The streets did not cross the square but passed along its periphery. A road ran all along the length of the wall separating it from the housing and enabling defenders to move quickly from one point to another in the event of sudden attacks.

Advantages for using the grid in the bastides were similar to the Roman colonial planning as a tool of military development.

Thus the advantages were:

1. Ability to allow for rapid development.
2. Ability to achieve an equality in land sub-division and public accessibility.
3. Ability to provide for easy troop movement.
4. Ability to police the town.
5. Ability to provide efficient servicing for the town.



CHAPTER I : HISTORICAL EXAMINATION

How and why the grid was used?

3. The Renaissance Ideal City

The renaissance period extended from the beinning of the 15th Century to the end of the 18th Century. It revived interest in classical urban form from Greek and Roman heritage. It was expressed by aesthetic uniformity such as use of elementary geometry, formal order and monumental character. During this period, market expansion and population exerted pressures on cities. Increase of density and the introduction of wheeled traffic made the city congested and its qualities deteriorated. Thus renaissance urban planning was limited in the expansion of existing area or redevelopment in part. Its intentions were:

1. Addition of new residential areas.
2. Restructuration of existing cities by the development of new street stystems which became key elements in the development of cities.
3. Regeneration part of cities bu the development of public spaces (squares and other public open spaces) relating to the street.
4. Development of a few new towns; many of them to be built but remained on plans as ideal cities.

The grid, as an important and fashionable urban component, was used to lay out expanded residential districts and the limited new towns. The main reason for using it was its facility for rapid expansion allowing for quick development to accommodate growth.

It was also used as an urban tool to achieve a high urban quality of spaces (squares and streets). Straight and wide streets gave monumental character and popularity to the townscape. As far as new towns were concerned, the grid offered a facility for troop movement and accessibility for policing the towns. Its ability to provide for an equality in land sub-division and public accessibility was another reason for using the grid.

Scamozzi's Ideal Town in 1615

Vincenzo Scamozzi (1552-1616) was an Italian renaissance urban planner. His ideal city was laid out on the grid-iron on the basis of a twelve sided town (Fig. 9). This shape is satisfactory in terms of aesthetic design and reduced by the length of required fortification. The streets crossed the open spaces (squares) at the middle to give a visual setting to public building located there. The straight and wide streets resulting from the grid-iron system gave monumentality and uniformity to the townscape. They also provided facility for movement. The variety and proportions of the streets and open spaces gave an unique balance to the whole layout.

Advantages for using the grid in the renaissance were:

1. Neutrality giving no conditions for adding new development to existing cities.
2. Ability to allow rapid development.
3. Ability to offer monumental character.
4. Ability to provide for efficiency in servicing the city.
5. Ability to provide easy troop movement.

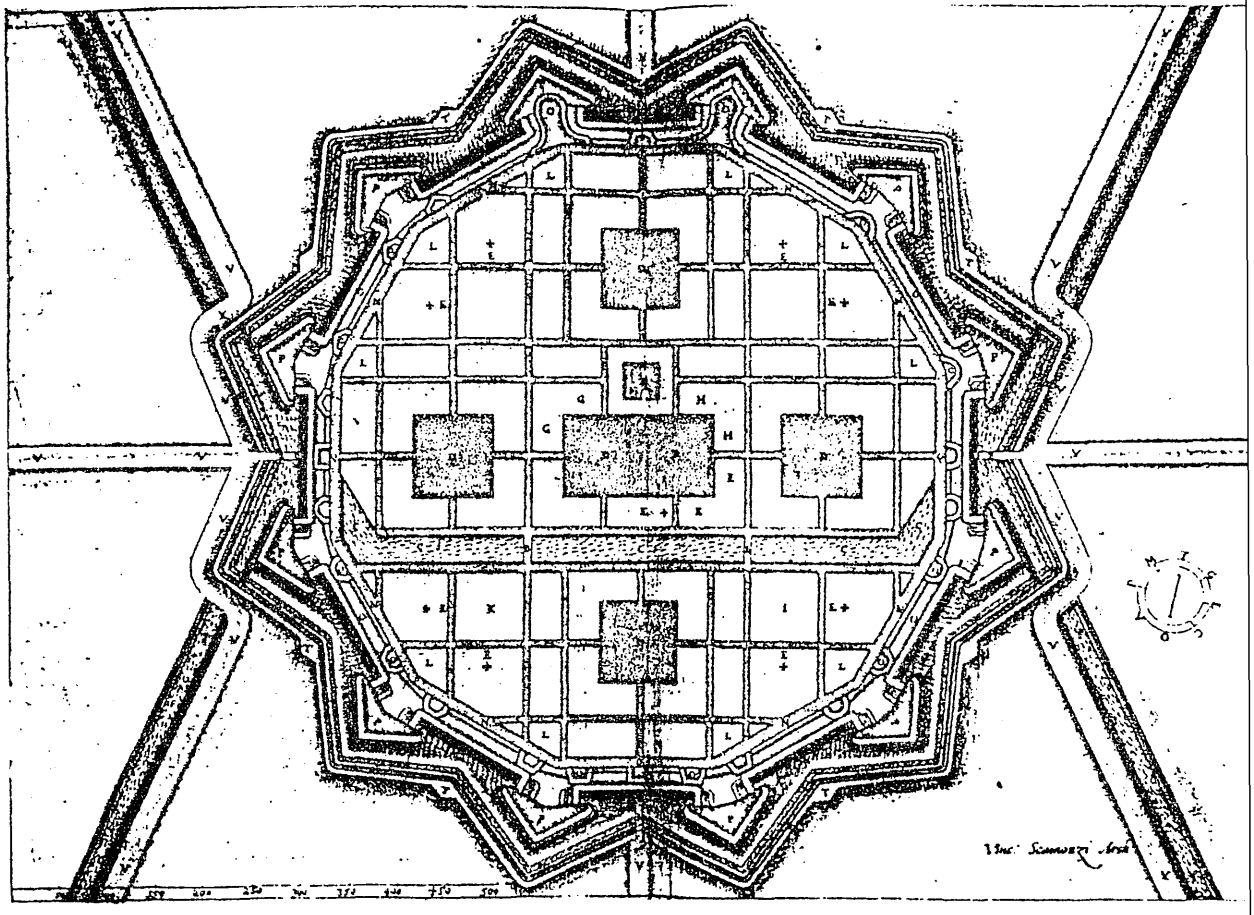


Fig. 9: Scamozzi's ideal city

6. Ability to police the city.
7. Ability to provide equality through land sub-division and public accessibility.
8. Ability to create a compact form easily defended.

CHAPTER I : HISTORICAL EXAMINATION

How and why the grid was used?

4. The Baroque Edinburgh New Town

The new town in Edinburgh was a reaction to economic expansion and population growth that the city experienced during the first half of the eighteenth century. The old town, compressed between the Castle and the Palace could no longer accommodate further growth and became congested. Consequently, in 1766, a competition was held for new development outside the old town to accommodate the new needs. The winning plan - James Craig's plan - (Fig. 10, 11, 12) was an extremely simple grid-iron curtained at either ends by two public open spaces (squares). Three long streets east-west, crossed by shorter streets at right angles. The central street (George Street) links the two squares (Charlotte Square and St. Andrew Square). The two other streets face gardens: to the north, Queen Street and to the south, Princes Street. The spatial configuration resulted in total of eight blocks; each one divided into two parts by a service lane, giving access to the mews. Four smaller surround the two squares (Fig. 13)

One of the most important features of the grid-iron layout in Edinburgh new town is the hierarchy of open spaces (streets) in both the whole layout (Fig. 14) and the block (Fig. 15). This hierarchy, achieved by dimensions and location, gives efficient transportation heirarchy and more accessibility.

The whole plan is inwards looking and makes Edinburgh new town a good example of comparison between two types of urban form

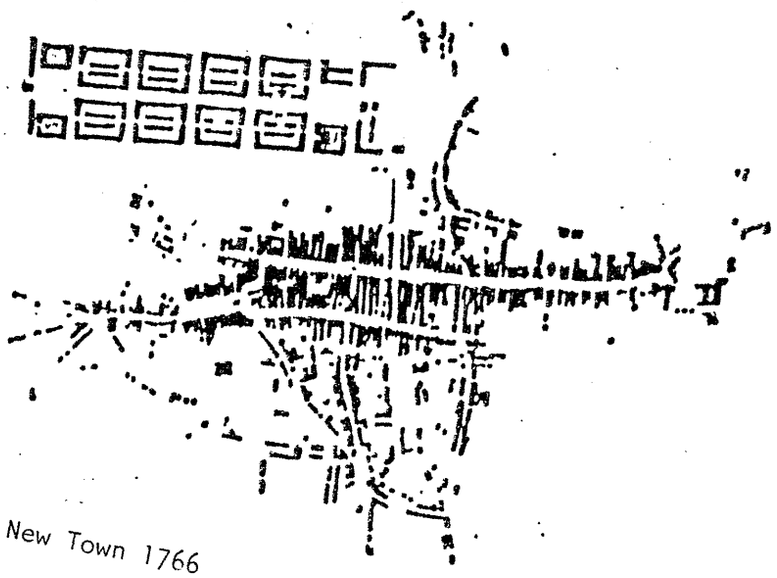


Fig. 10 : Edinburgh Old and New Town 1766

Fig. 11 : Edinburgh Old and New Town, 1:15000

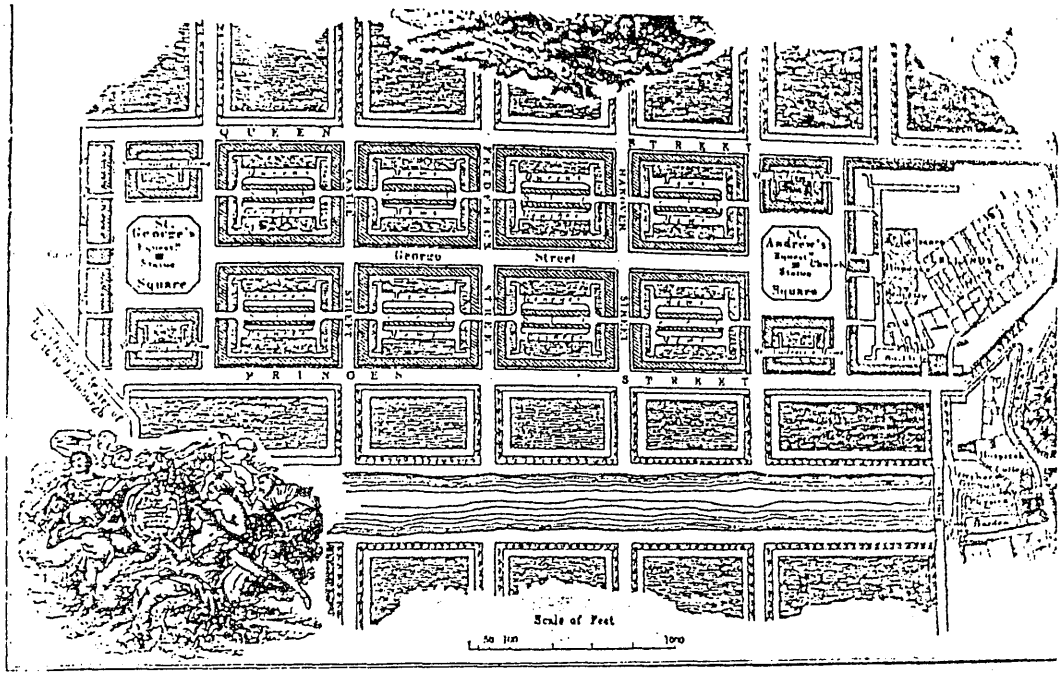


Fig. 13: Edinburgh New Town: Configuration of the grid

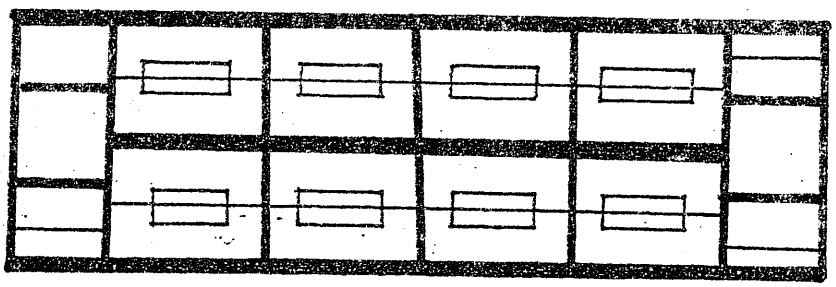


Fig. 14: Edinburgh New Town: Hierarchy of traffic

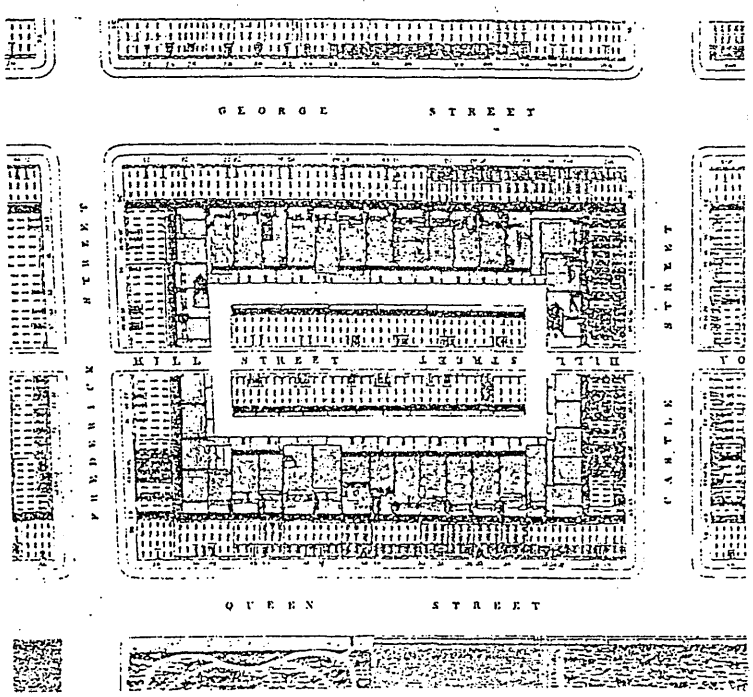


Fig.15: Edinburgh New Town, a typical block

development. The new town's plan is formal and regular whereas the old town's is informal and irregular.

James Craig did not design any of the buildings. The development of the new town was based on speculative plots and the entrepreneurs built for profit. For this purpose the grid was a tool for land speculation due to its ability to produce equal pieces of land and to give the same right for public access.

The Edinburgh grid is a space management grid; the straight and wide street (George Street) is terminated at both ends by public building which gives visual appeal. The regularity and the formality of the facade with grandiuous treatment offers a high urban quality of renaissance urban tradition. (Fig.16) The balance between street, plots and buildings, the proportions of open spaces, the architectural palace treatment of the facades and the urban furnitures at streets intersection make Edinburgh New Town a masterpiece of urban design which configurates a curtained grid.

Advantages for using the grid in Edinburgh New Town:

1. Allocation of land speculation and land sub-division.
2. Social equalisor; efficiency of producing equality in land sub-division and public accessibility.
3. Urban design reasons.
4. Servicing the town.
5. Ability to provide for rapid development.

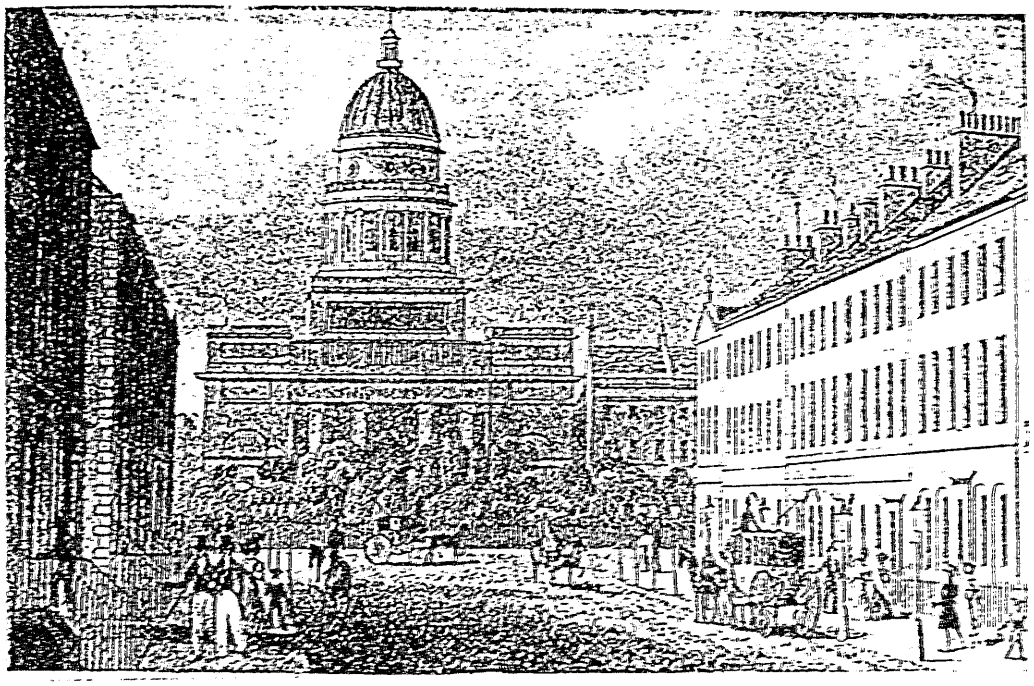
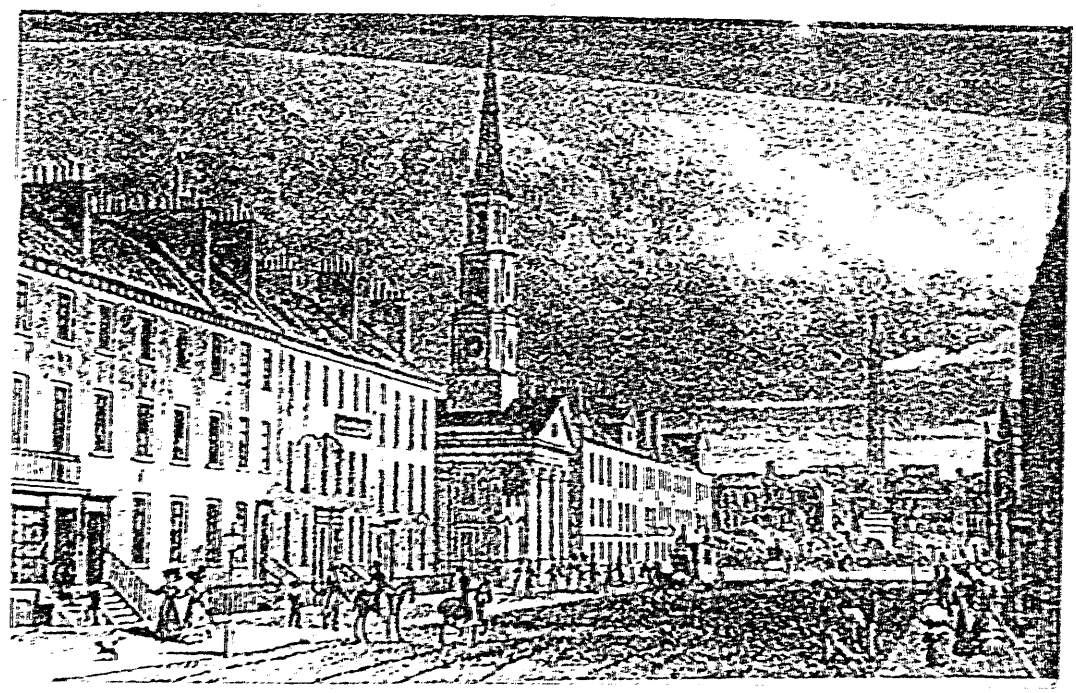


Fig. 16 : Edinburgh New Town: George Street



CHAPTER I : HISTORICAL EXAMINATION

How and why the grid was used?

4. Colonial America

Most of the American cities were originally laid out in colonial style by European ventured across the sea to the new land. The grid was the simplest means of developing a new settlement:

> "The plan of the place with its square, street and building lots was to be outlined by means of measuring by cord and ruler, beginning with the main square from which streets were to run to the gates and principle roads, and leaving sufficient open space so that even if the town grew, it could spread in a symmetrical manner." (12)

The grid's ability to provide for an easy method of land survey and speculation and rapid development was expressed by Henry Raldrich:

> "The great facility which it provides for gambling in land value and ready purchase and sale of buildings, which had wrought incalculable mischief." (13)

Another reason for using the grid in America was the American land ordinance of 1785 by which national land policy was adopted. This represented a compromise between the government's desire to raise public funds from the sale of land and mounting pressures from the countless thousands who wanted enough land, preferably as a grant for a farm.

The law required that the territory to be sold should be laid out in rectangular townships, 6 mile square. Each township was to be divided into 36 square sections of one square mile or 640 acres. Half the land was to be sold by townships,

the other half by sections. The rectilinear survey basis obviously disregarded topography, with many anomalous results, but it was easy to locate a purchase in the wilderness and to avoid boundary disputes. (14) (Fig.17) The first seven ranges of township were surveyed by 1786 west of the Ohio River (Fig. 18). Since then the grid had spread across the whole country as an ideal pattern for land speculation and land sub-division.

Advantages for using the grid in America:

1. Allocation of land: land speculation and land sub-division. (Fig. 19,20)
2. Ability to provide expansion allowing rapid development. (Fig. 21,22)
3. Neutrality and freedom in adding new development.
4. Ability to achieve equality in land sub-division and public accessibility.
5. Ability to provide for an efficient servicing the city.

But the huge grid development in America created monotony and infinity of urban form of the American city. Savannah is a typical example which used the grid more expediently than most other American cities. John Reps sees it as one of the misfortunates of American town planning. (15)

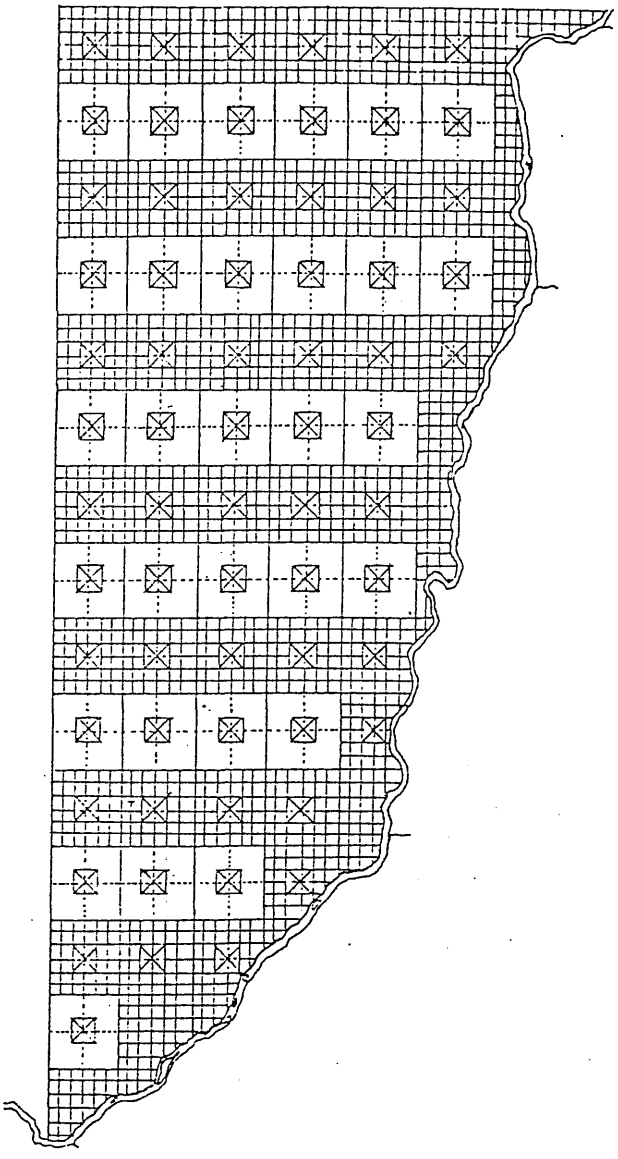


Fig. 18: Map of the first townships surveyed in Ochio according the land ordinance of 1785

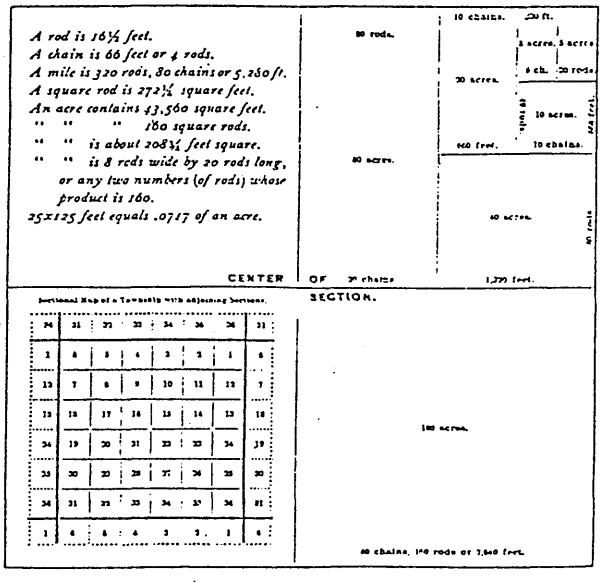


Fig. 17: A section of land 640 acres

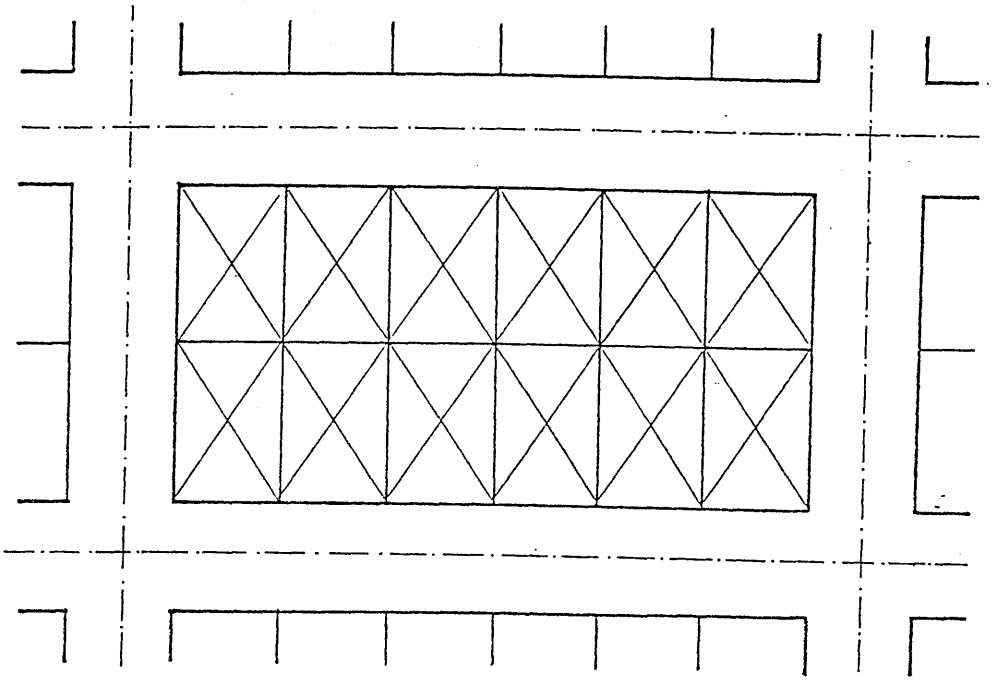


Fig.19 : The grid's ability to give multiples

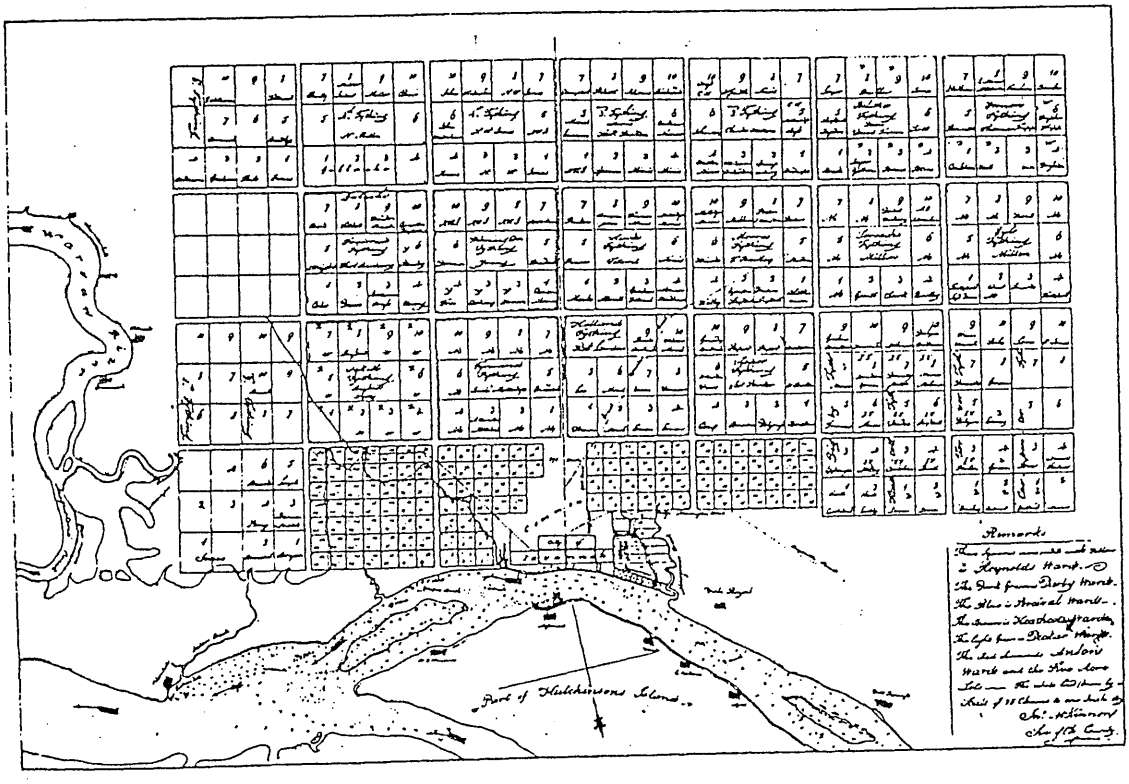


Fig. 20: Map of Savannah, 1800

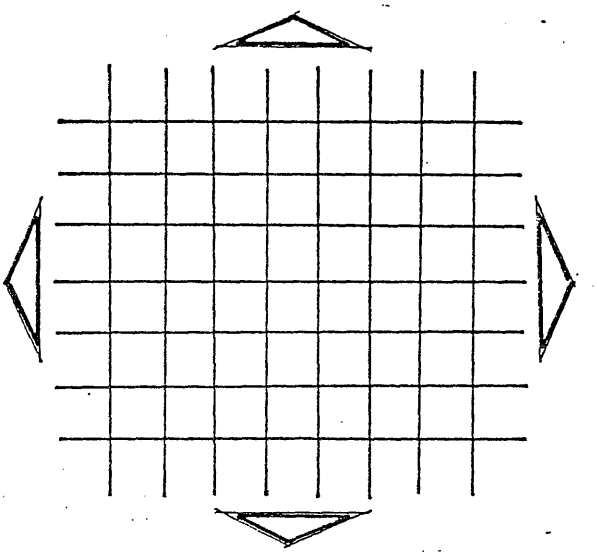


Fig. 21: The grid: Neutrality and expansion

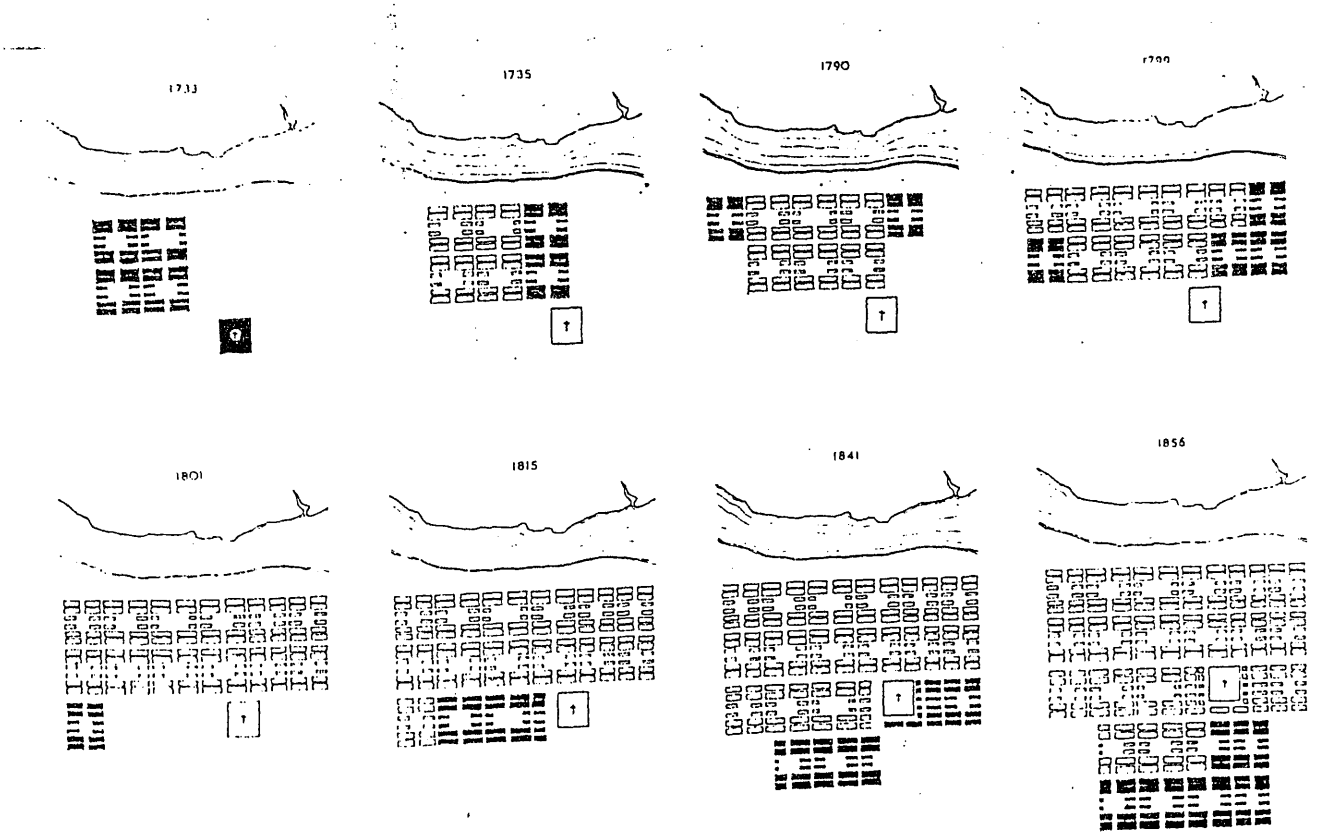


Fig. 22: Savannah: sequence of development

CHAPTER I : HISTORICAL EXAMINATION

Conclusion

From the historical examination, there is continuity of reasons for using the grid as means of development of urban settlement. Each society used it for mainly the same reasons but as the preceeding historical period but the reasons differed only in relative importance from one society to another. It could be concluded that the reasons were:

1. Allocation of land speculator and land division:
   - ease of definition along two axes easily dimensioned by right angle.
   - ease to divide to give multiples.
2. Its ease to survey and to locate a purchase.
3. Its ease for rapid development to accommodate cities' growth.
4. Efficiency of producing an equality in land sub-division.
5. Ability to provide for an equality in public accessibility.
6. Efficiency in servicing the city:
   - grid offers more accessibility and contact between buildings and public spaces.
   - it gives more possibility to serve buildings as a linear solution.
   - it allows efficiency to serve building in terms of networks.
7. Neutrality and freedom offering no condition in adding new development.

8. In urban design, straight streets terminating by public building gives formality and monumental character.
9. Its ease for troop movement.
10. Its ease to police the town.

Among these reasons, there are some which are still relevant for today especially for new developments. Its ability to provide for rapid and easy development and its ability to achieve equality in land sub-division and public accessibility are significant reasons for chosing the grid as tool of urban planning for new developments. Its efficiency in servicing the city is still one of the most important feature of the grid which differs it from other means of development. This reason, whose relevance will be discussed in the second chapter, has been fashionable for latest development as the case of Milton Keynes. In urban design, the urban qualities of the grid is not relevant unless the design obeys to the criteria of urban planning and design.

Today our cities have reached a saturation point. They cannot expand further and new developments are more efficient than cities expansion.

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CHAPTER II : THE RELEVANCE OF THE GRID TODAY

CHAPTER II : THE RELEVANCE OF THE GRID TODAY

1. Existing Cities

1.1 Historical Examination

Before examining the relevance of the grid in the three 19th Century cities: Barcelona, Glasgow and Chicago, an historical background is necessary to understand how and why grids have been used and to end the historical examination in the first chapter by the 19th Century and the 20th Century whose example will be Milton Keynes.

1.1.1 Barcelona

Today Barcelona is the econmic centre of Spain. Its port made it the most prosperous Spanish city. Originally, it was founded in 230 BC as a Carthaginian settlement on the Mediterranean sea. The Roman old town (Barrio Gotico) is still dectectable by its walls and the fragments remaining of the original pattern of streets. During medieval times, a new town was added to the southern boundaries of the old city. A new residential area (Barceloneta) was subsequently added and developed outside the city walls in the 18th Century. The mid-nineteenth century marked a high point in the development of Barcelona with the Cerda plan for a city extension known as the "Ensanche". The fortified walls were taken away as a part of the new development. The Cerda plan of 1850 (Fig. 1, 2) was a classical network which combined the grid layout with the beauty of diagonals and boulevards that connected and integrated the nearby small towns with the old city

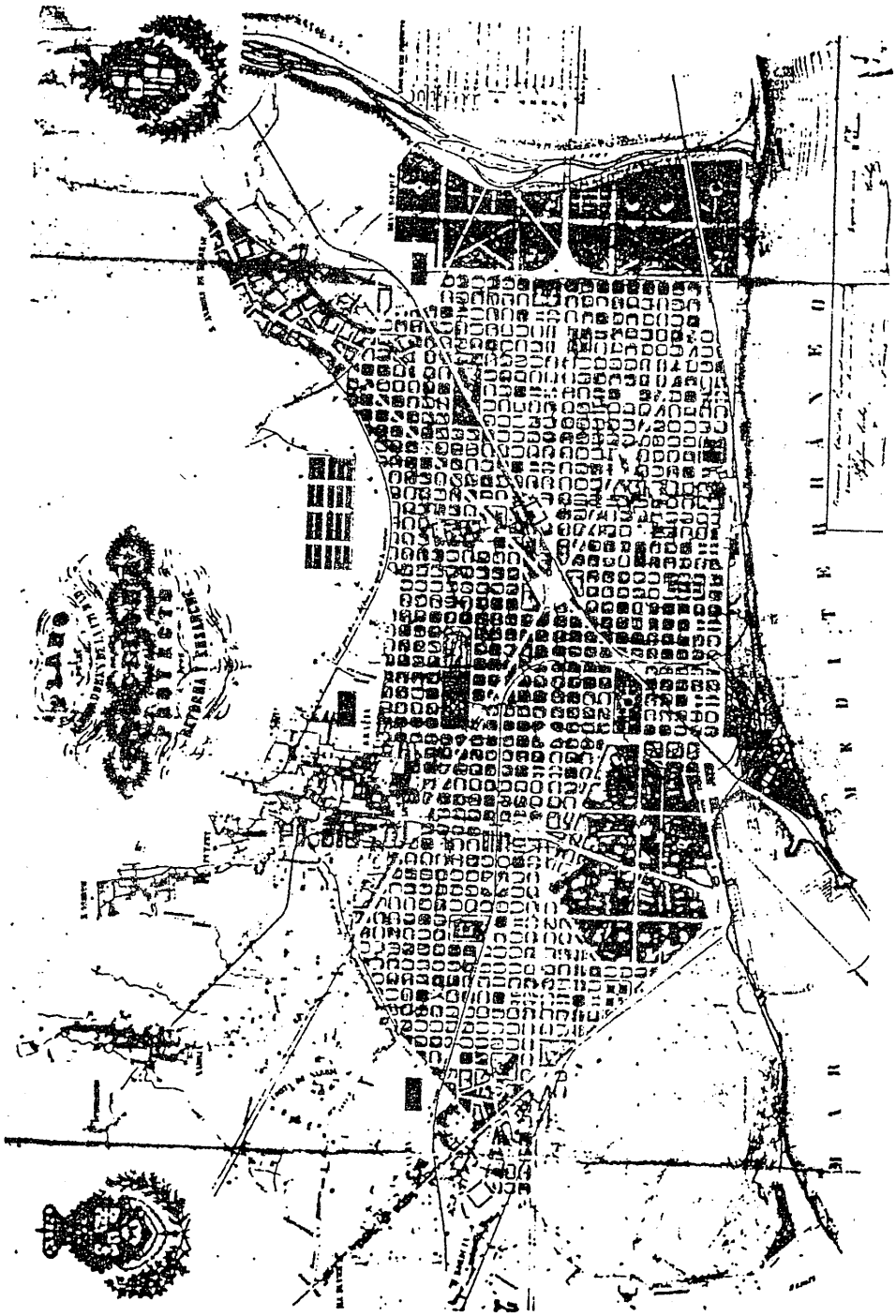


Fig. 1: Barcelona: Cerda plan

Fig. 2: Barcelona, 1:15000

of Barcelona as well as greating a completely new centre.

Ildefouso Cerda (1815-1876) architect and planner, designed the plan with a scientific approach, including statistical research into the expected composition of the population and the suitable provision for traffic in an industrial town. The plan was based on the grid-iron characterizing extensibility and rapid and easy development allowing provision for a large expansion of the city. As any city at that time, Barcelona adopted the grid for rapid development to accommodate population growth which was extremely high (Fig. 3).

There are two main features of Cerda plan.

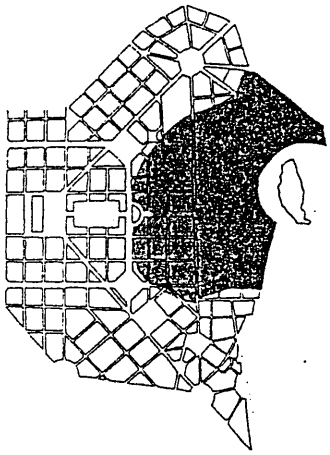
1. The grid module with its chamferred corners is the urban unity which structure the whole layout. The cut-off corners enclose the fundamental urban space and also act as the strongest and most characterized image of Barcelona. Thus Cerda designed the meeting of four streets as the important urban unity. His concern with individual buildings form was less except in the dimension between street intersections and building measurements.

2. The introduction of diagonals and boulevards to break the rigidity of the grid and to give a hierarchy in the street movement.

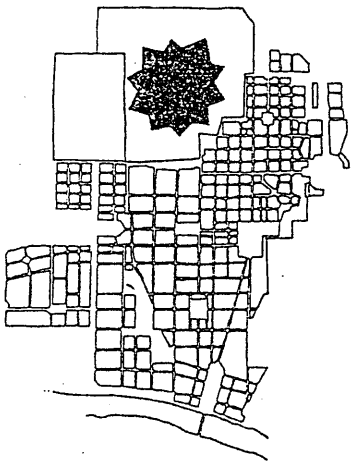
The whole layout gave a varied and dynamic image despite the repetition of the blocks and the high density of housing.

Advantages for using the grid in Barcelona:

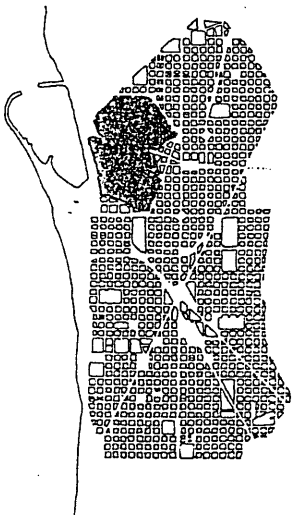
1. Ability to provide for rapid expansion.
2. Ability to provide for an easy development to accommodate the city growth.



Athens, Keanthis - Schubert Plan, 1833

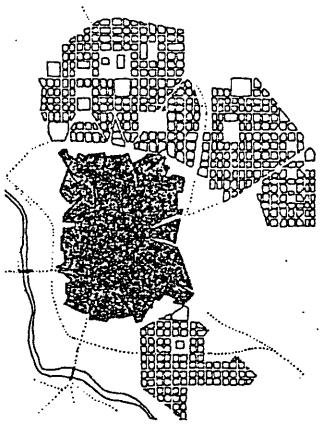


Torino, piano dell' Antonelli, 1852

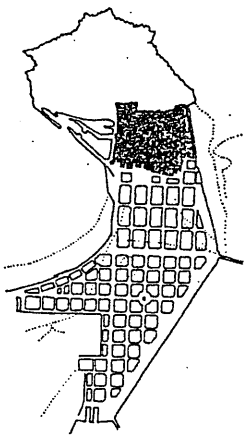


Barcelona, Plan Cerdá, 1858

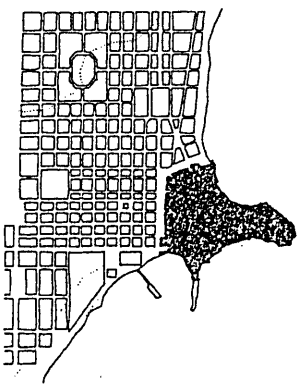
Algeri, Plan Chasserian, 1858



Madrid, Plan Castro, 1860



San Sebastián, Plan Cortazar, 1864



Bari, piano Trotti, 1867

Fig. 3: The grid as planning tool in the 19th Century to accommodate cities growth

3. Neutrality from scale offering an ease for new addition.
4. Servicing the city in terms of accessibility and movement.
5. Urban design form.

CHAPTER II : THE RELEVANCE OF THE GRID TODAY

1.1. Historical Examination

1.1.2 Glasgow

Not too much is known of Glasgow in pre-historic time but by the medieval times it had grown to a small town whose church was an important religious centre. The Cathedral was built on a small hill near the lowest fording point of the Clyde. (Fig. 4)

It was a focal point around which the town began to grow and its scale must have contrasted with the small dwellings nearby. Two centuries later, the Market Cross area became a lively commercial centre. The two centres were connected by High Street which was the result of the attraction and interaction between them. The establishment of the University in 1561, on the upper end of High Street, further encouraged the growth of the town. By the 18th Century, commercial success was reflected in new extension and many streets were opened up. The wealthy merchants developed beautiful and new villas and mansions which were an important component in the design of the city centre. The new extension was planned as a unit and showed new sense of town planning and has a great architectural interest. The city accumulated its wealth from tabacco trade and later shipbuilding and cotton production.

As a result of trade, the standard of living increased and overcrowding in the central area had reached a new level; expansion was required to accommodate the new growth. Proposals to design the first new town were prepared by James Barry in 1782 (1) (Fig. 5). The plan was logically the extension of the existing street pattern.

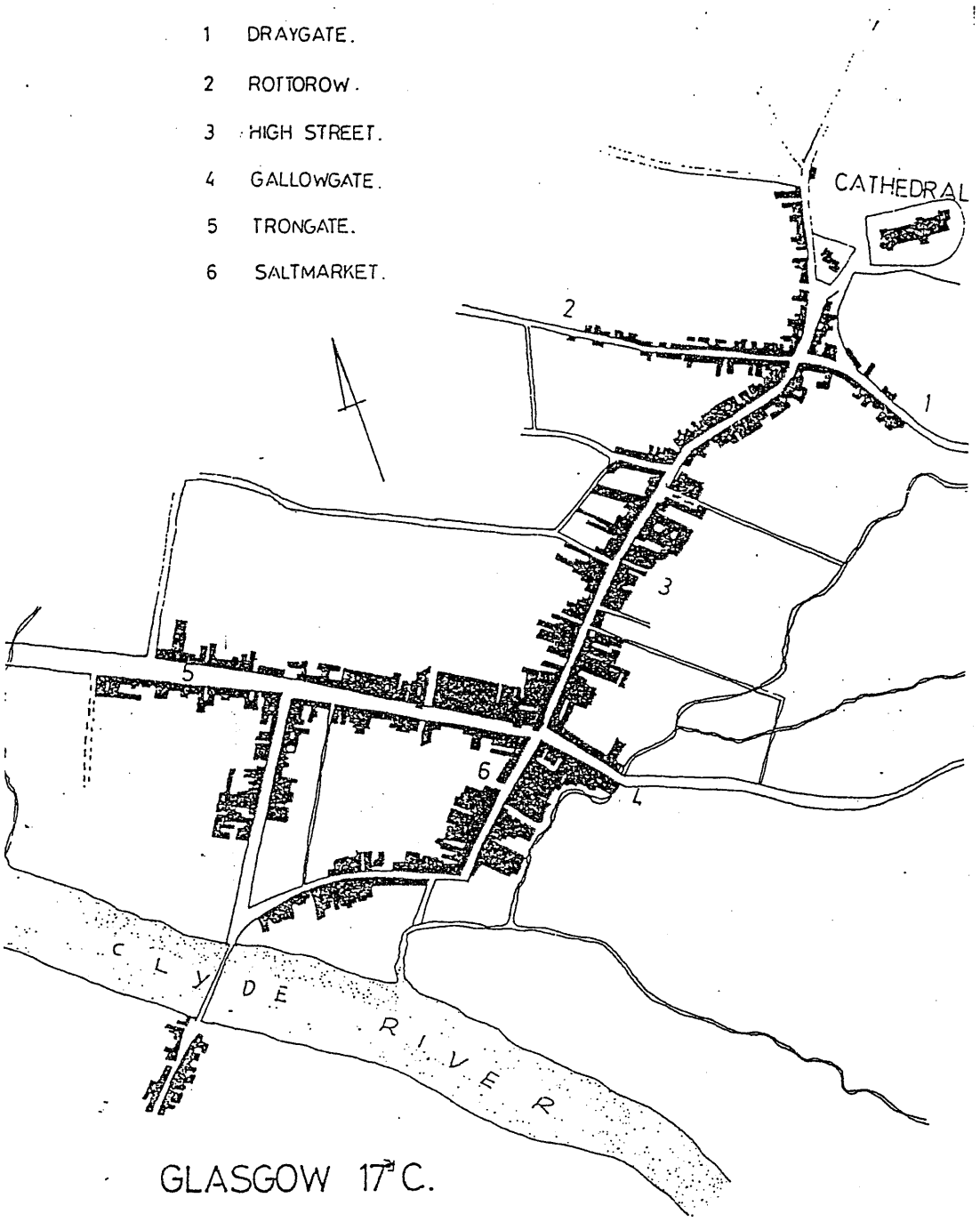


Fig. 4: Glasgow: the Medieval Town

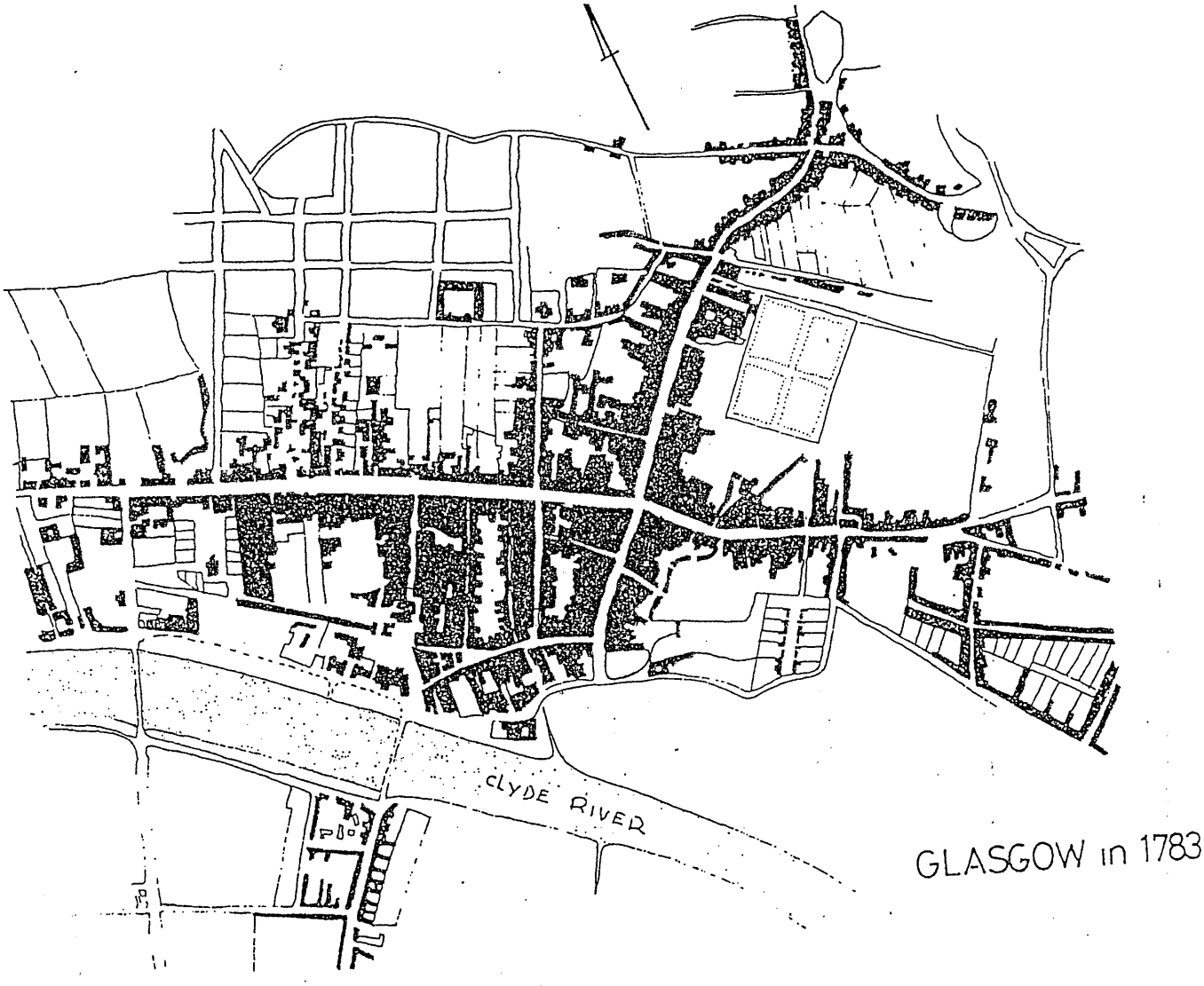


Fig. 5: Glasgow: James Barry's map

The grid made its appearance. Its use was a gesture towards social democracy in the sub-division of land and ownership and public accessibility. In addition to its efficiency of producing an equality, it has also the beauty of geometry and regularity in the art of city design. By the end of the 18th Century, as building went ahead around George Square, the final portion of what is known today as the Merchant City, was completed. Buchanan Street was one of the last streets opened. The first New Town plan was the most ambitious and the largest extension ever planned in the city. Its character was exemplified by George Square which is the finest element of Barry's design and also public building in squares as the Royal Exchange Square with Sterling Library as termination vistas.

By the end of first decade of the 19th Century, further extension had been laid out on Blythswood lands. (Fig. 6) The layout of the second new town was largely determined by a number of pre-existing factors:

- Two long roughly parallel but widely separated routes crossed Blythswood land: from east to west: to the north; Sauchiehall Street and to the south Argyle Street. The two routes crossed Buchanan Street at right angles.
- The beginning of St. Vincent Street and West George Street had been planned from the first new town and they also cross Buchanan Street at right angles.

These two factors were significant in adopting the grid. The private development was the most determinating reason for using the grid whose ability to provide for an ease to divide giving multiples

Fig. 6: Glasgow 1865
1:15000

and for an equality in land sub-division and public accessibility. It was also motivated by its ease for rapid development to accommodate city growth.

The second New Town plan was an extremely rigid grid-iron and it was for the first time, the Glasgow grid had been adopted to a sloping site. On the top of the hill, Blythswood Square was built up as a residential square. The new layout transformed Sauchiehall Street from irregular thoroughfare to a wide and straight avenue built up with rich individual houses. St. Vincent Street built up with elegant short terraces.

Glasgow grid was based on speculative planning as in America, therefore the reasons are similar.

Advantages for using the grid in Glasgow were:

1. Allocation of land: land speculation and land sub-division.
2. Ability to achieve an equality in land sub-division and public accessibility.
3. Ability to provide for an easy and rapid development to accommodate city growth.
4. Ability to provide for an efficiency in servicing the city.
5. Ability to provide a visual framework for future development (urban order)

CHAPTER II : THE RELEVANCE OF THE GRID TODAY

1.1 Historical Examination

1.1.3 Chicago

Chicago is America's second city. It has experienced a most spectacular growth in population and commercial pressures. By 1729, the first European settlement began and by the beginning of the 19th Century, Chicago contained a few housing and a fort. In 1833 they were four hundred people and two hundred houses and in 1865 population was about 180,000 people (2). Since 1782 it had doubled and in 1885 it had quadrupled.(3) The first plan of Chicago was drawn by James Thompson in 1830 (Fig. 7). It is a grid-iron plan which is clearly seen in the vast grid modern Chicago. All the new succeeding additions are connected to or parallel with Thompson's original grid system. Thompson's plan referred to land ordinance in 1785 by which new town was laid out to pay expenses in Section A, Township 39, Range 14 (4). Harold M. Mayer and Richard C. Wade, described the original plan:

> "The original plot of Chacago was simple and conventional like most towns of the time. It followed the grid system. Only three eighths of a mile square, it straddled the banks of the river. The popular sixty six feet width was adopted for the streets. Alleys sixteen feet wide through the centre of each block. The orginal design also provided for streets along the banks of the river. The rectangular grid iron system was reinforced by Federal ordinance of 1785, which called for driving the new country into mile square sections. Beyond the boundaries of the first plot, the edges of those units furnished conenient location for street" (5).

The grid, as in the whole country, was the ideal pattern for land speculation and sub-division. Harriet Martineau described some of the events she observed when she visited the city in 1836:

> "I never saw a busier place than Chicago was at the time of our arrival. The streets were crowded with land speculator." (6)

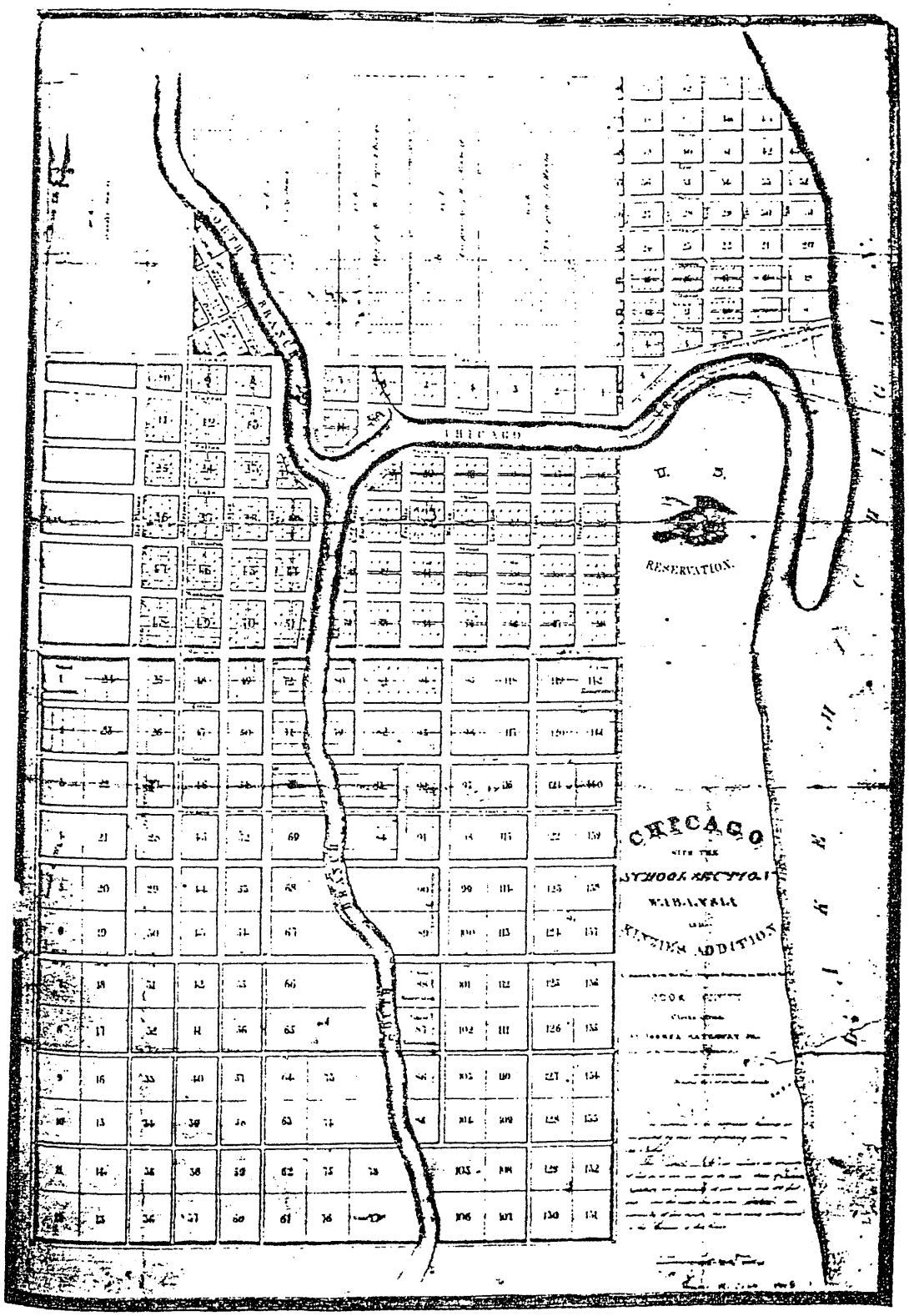


Fig. 7: Chicago: Thompson's map of 1830

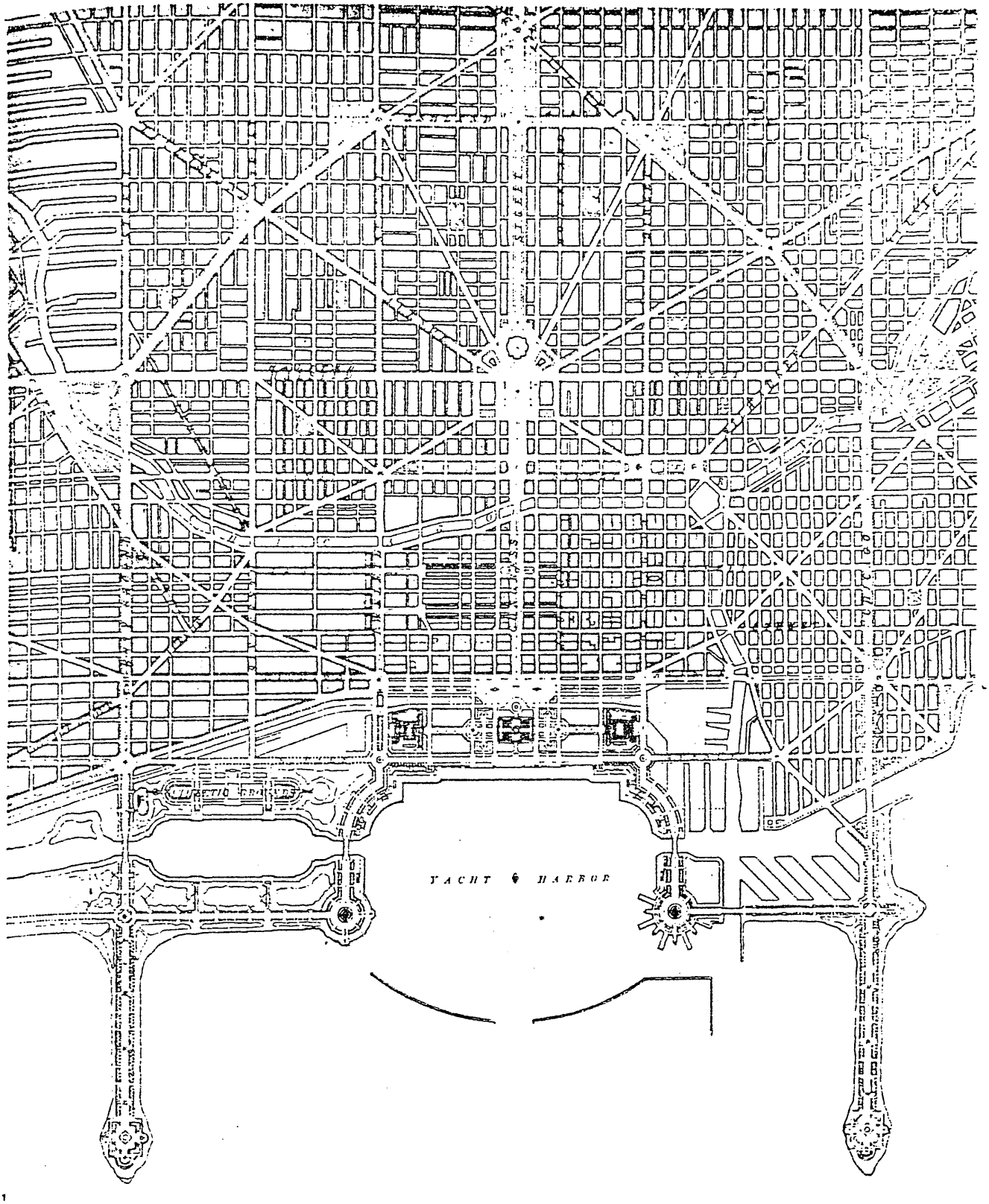
However, the advantages for using the grid in Chicago are those outlined previously in the first chapter under colonial America:

1. Allocation of land: land speculation and land sub-division
2. Ability to provide expansion allowing rapid development
3. Neutrality and freedom in adding new development.
4. Ability to achieve equality in land sub-division and public accessibility.
5. Ability to provide for an efficient servicing the city.

In 1893, the world's Columbian Exposition in Chicago gave an opportunity to the urban planner to reshape the city and Daniel Burnham proposed his famous plan for the city in 1909. (Fig. 8) The plan became the guideline for the future development of Chicago. In the words of the authors (Burnham and Roots):

> "It should be remembered that the purpose has not been to invent novel problem for solution, but to take up the pressing needs today and to find the best methods of meeting those requirements, carrying each particular problem to its ultimate conclusion as a component part of a great entity, well ordered, convenient and unified city." (7)

A further study of the plan is in the comparison between the three cities: Barcelona, Glasgow and Chicago.



ig. 8: Chicago plan of 1909

CHAPTER II : THE RELEVANCE OF THE GRID TODAY

1.2 Changes in Society and Resultant Effects on the Grid

During the last century, dramatic changes have occurred on society. New pressures and needs have emerged creating confusion which we have yet been unable to resolve. Their effects have been crucial on the urban environment in both the functioning of our cities and their townscape. The grid pattern of many of our cities has been strongly affected by those changes as they were laid out in a previous era in which it was difficult to forecast such dramatic changes. Amongst those changes is technology which has brought the most delicate situation.

1.2 Technological Changes

This century has witnessed an enormous technological advance by:

The advent of the car

The invention of new material and new construction methods

New techniques in environmental sciences such as lighting and air conditioning and in servicing cities

The new development could not fit in our traditional environment and new concerns for change led to renewed interest in our environment.

1.1.1 The Advent of the Car

The car is both an advantage and a disadvantage. On the one

hand, it gave tremendous freedom and mobility and has become a very important part in our life. On the other hand, it has created congestion problems to which we have not yet found all the solutions. These problems could be resumed in three points:

1.2.1.1 - speed

1.2.1.2 - traffic congestion

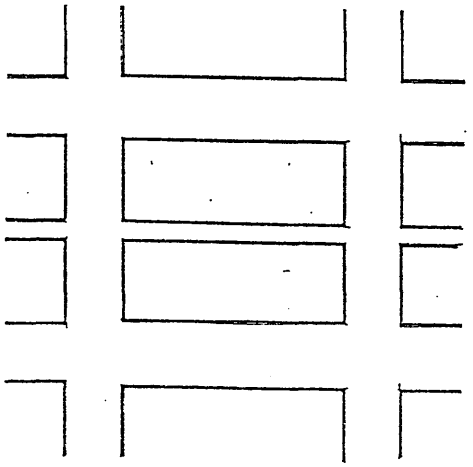
1.2.1.3 - conflict between car and pedestrian

1.2.1.1 Speed

Increase in speed by a factor of three times requiring an increased distance to allow fluidity resulted from the development of transportation system as it changed from foot and horse drawn vehicles to the motor car. The distance required for the first means of transportation are no longer relevant for the second one. The grid, by definition, is the intersection of parallel street with another set of parallel streets at right angles. This defines the distance between two control points; the distance effects the speed of movement. The longer the distance, the more efficient is the mobility.

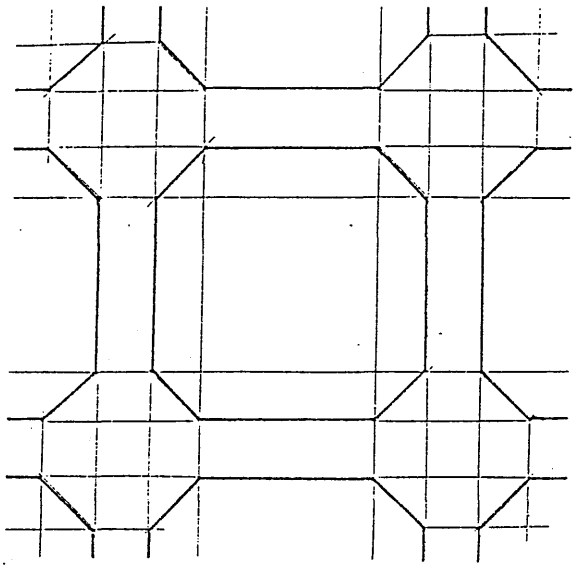
Examining the three grid modules of Barcelona, Glasgow and Chicago (Fig. 9, 10), Glasgow's is the shortest and Chicago is the biggest. Chicago is twice as big as Glasgow and Barcelona. Therefore, Chicago's is the most relevant to the motor vehicle , it allows for more traffic mobility.

If the distance between two control points in the grid is great, it may suit the motor vehicle but it affects the grid



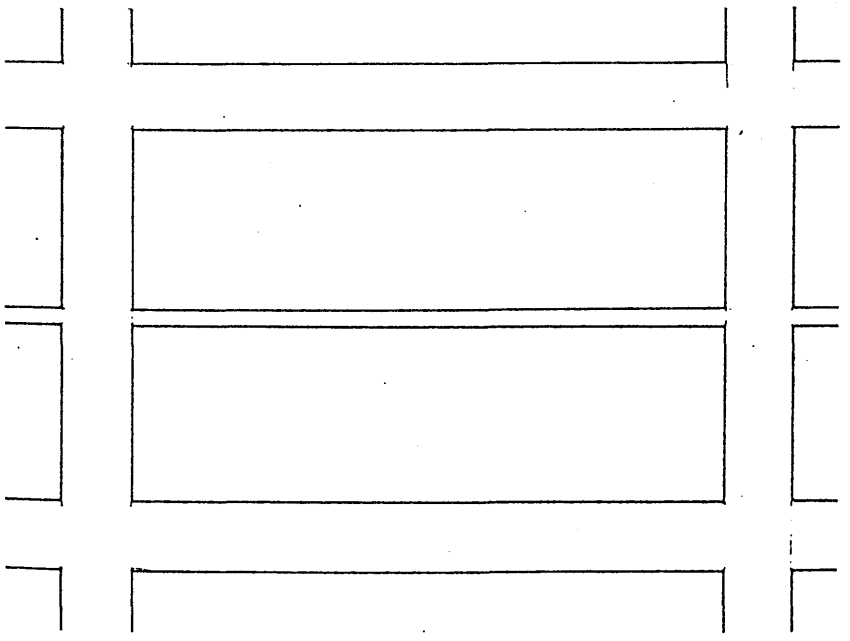
Glasgow's grid

81m x 62m



Barcelona's grid

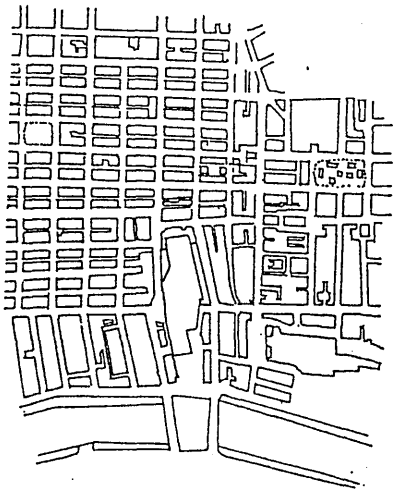
100m x 100m



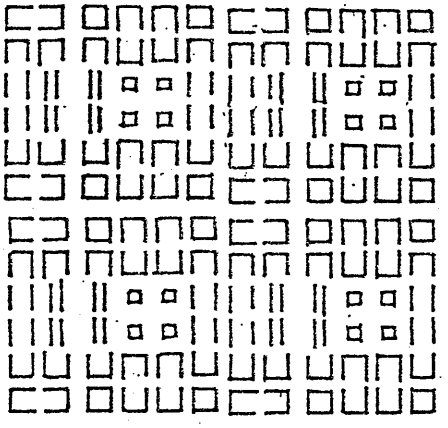
Chicago's grid

200m x 125m

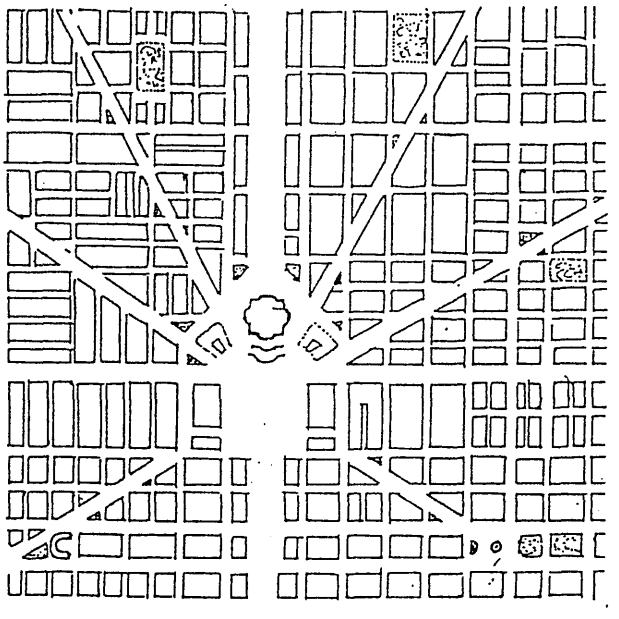
Fig. 9: Comparison of the grids



Glasgow



Barcelona



Chicago

Fig. 10: Comparison: City block

efficiency.

In Chicago, Burnham was

> "the only American urban planner who realized earlier than anyone else that automobile traffic and the expansion of the city towards the suburbs demanded replanning." (9)

His plan for Chicago in 1909 aimed to improve the transportation system. Public transportation is one of the most important city services. In Chicago today about a half million people working in the city centre use public transportation Burnham introduced diagonals, boulevards and ring road connecting all the open spaces. (Fig. 12) This new network is to carry arterial traffic. He also introduced a programme of street widening. He seggregated through traffic from local traffic by emphasis on certain streets. Thus he created a grid within a grid. The ring grid is for fast traffic and the inside grid is for local traffic. (Fig. 13)

He wanted also to transform the urban desert by means of vistas and focal points in the city "beautiful" (10). The plans major provisions were:

- An east-west boulevard from the lake into the prairie horizon.
- The development of a civic centre (Fig. 14)
- The acquisition of green belt.
- The creation of lake front parts and beaches.

Similarly, Cerda in his plan for Barcelona (Fig.15,16, 17) made provisions for traffic by introducing diagonals and boulevards connecting the city with its surroundings. His concept of the city "is of necessity no more than a kind of station of waiting

efficiency in three other ways:

1. It results in great pedestrian distances.
2. It gives less accessibility for servicing (this point is discussed in density).
3. It creates monotony from townscape point of view.

To propose a solution to these three disadvantages of a long distance of the grid module, seggregation of the two types of movement (pedestria and motor vehicle) is perhaps advantageous. The long distance for the motor vehicle can be separated from the shorter one which suits the pedestrian and gives more accessibility and also breaks the monotony.

Leon Krier (8) tackled this kind of problem in his project in Barcelona where he sub-divided the original grid module into smaller units. The ring grid is kept for motor car traffic, whereas the inside is pedestrianized (Fig. 11) .

1.2.1.2 Congestion Traffic

During the last century, the city centre has become the centre for commerce, industry and traffic. Glasgow and Chicago were among the greatest Victorian commercial and industrial centres in the world. Barcelona was the greatest economic centre in Spain. The high concentration of activities in the centre brought a great concentration of people and traffic affecting transportation of people and goods. In Chicago and Barcelona, priority was given to the improvement of transportation and the increase of traffic capacity in their centres, and to remove all obstacles which prevented or disturbed circulation, all to the improvement of

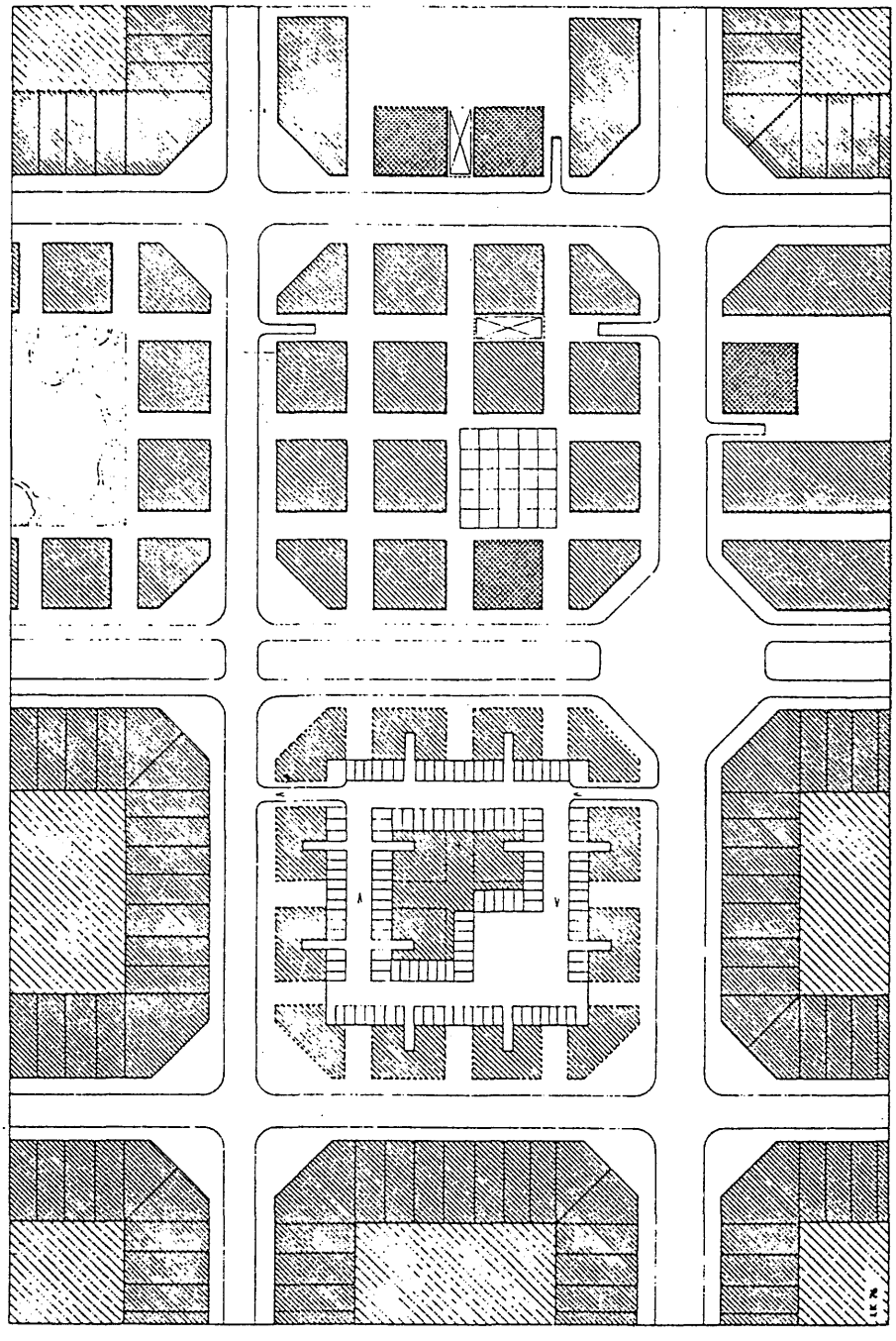
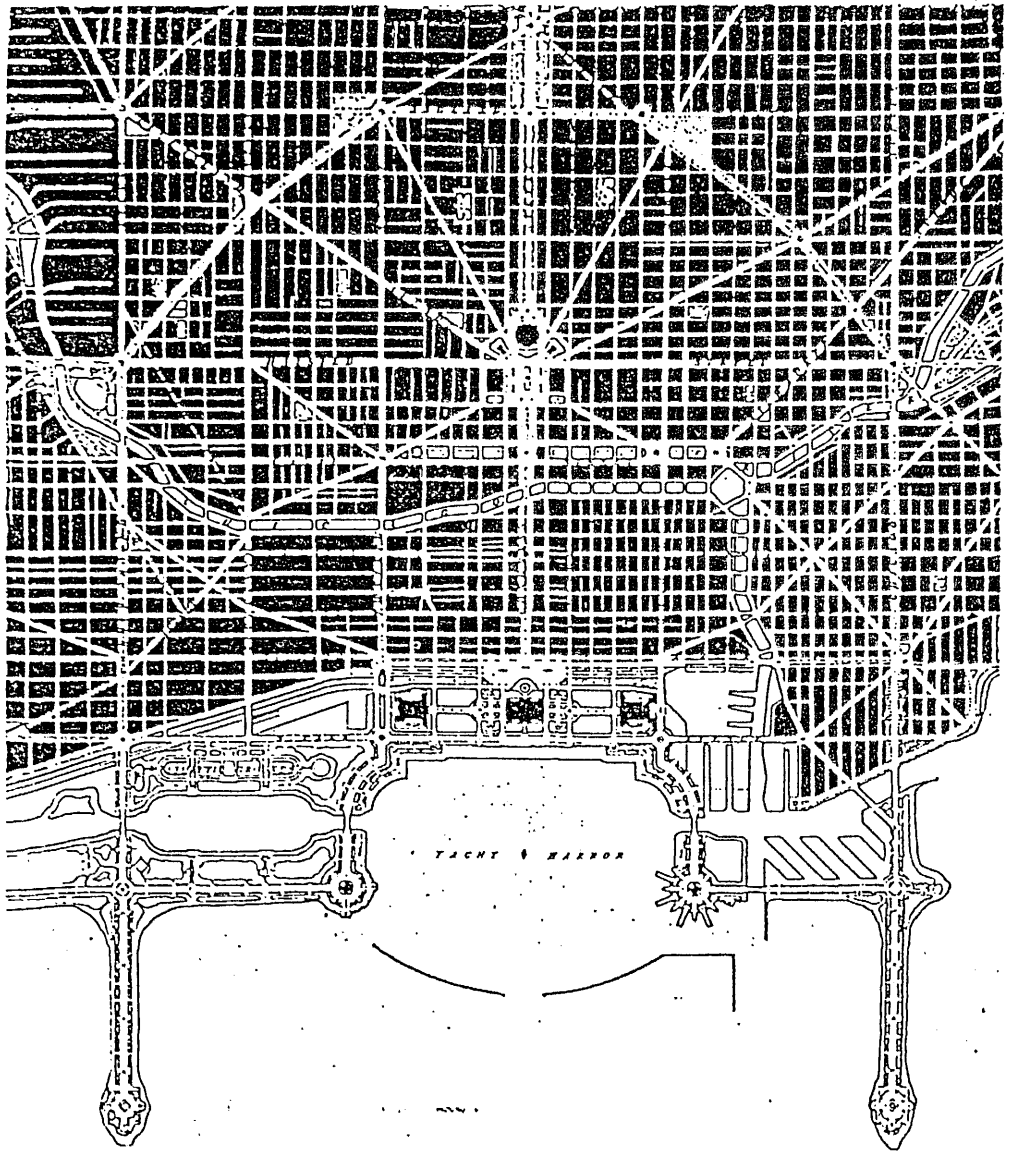


Fig. 11: Leon Krier's project in Barcelona



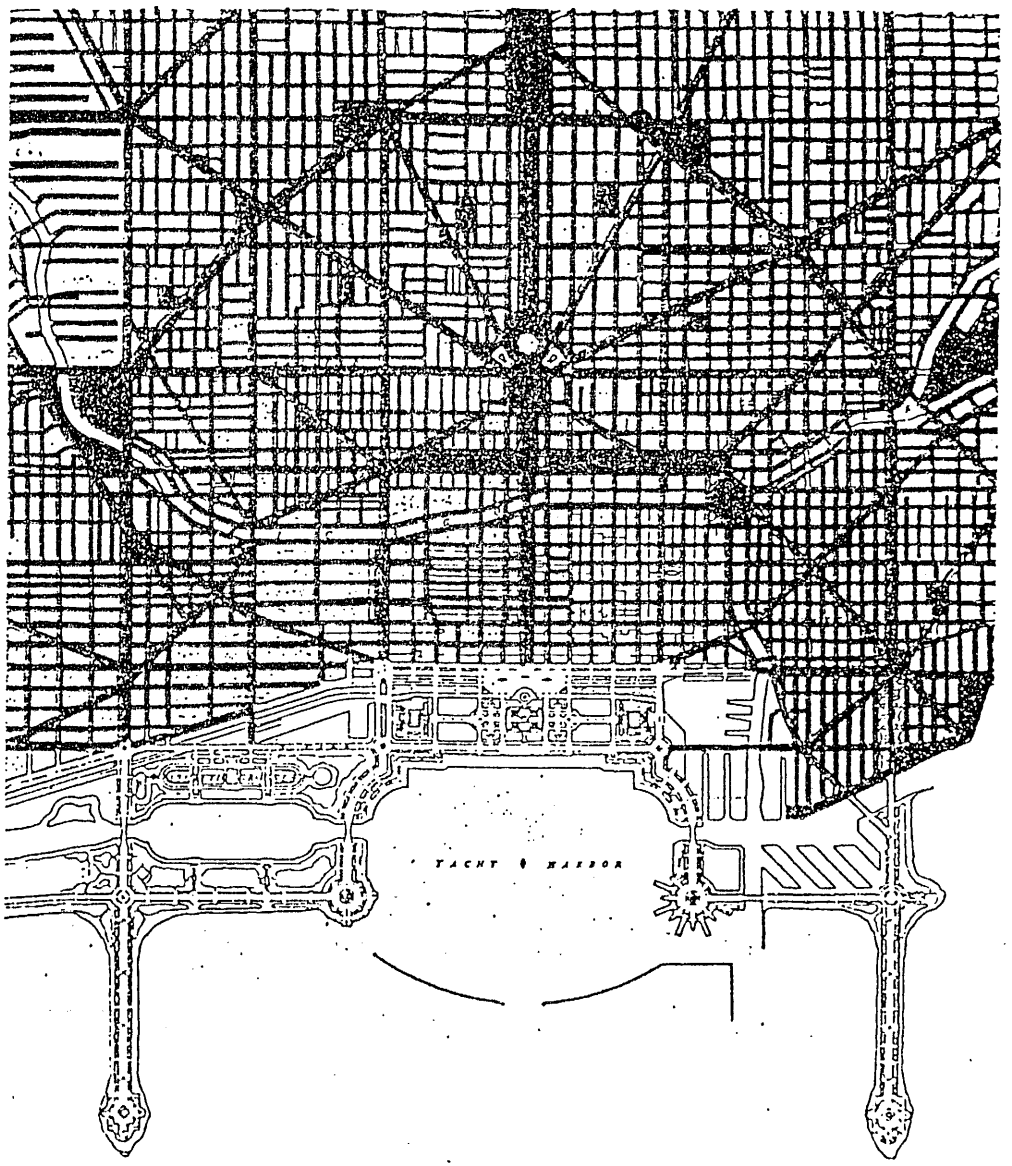


Fig. 12: Chicago: Urban form maps

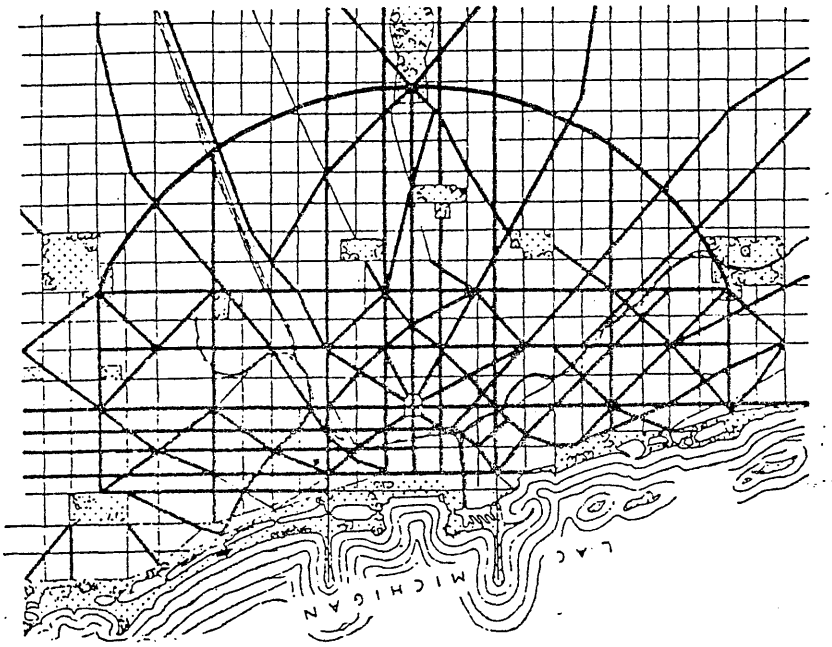
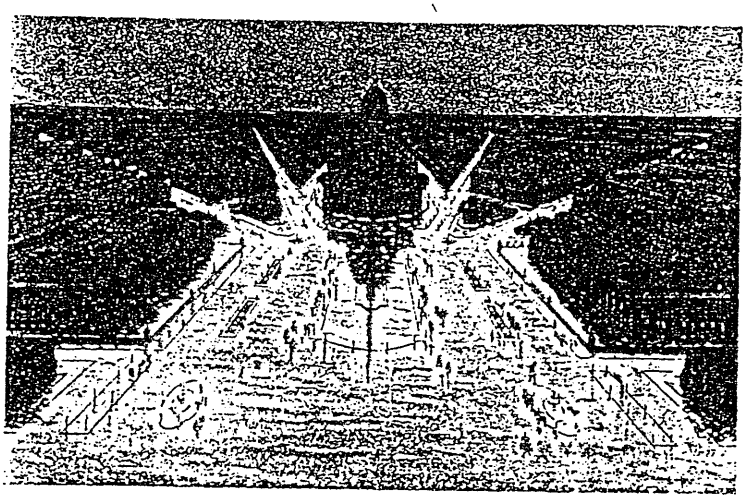


Fig. 13: Chicago plan of 1909:

Diagram shows the super-grid



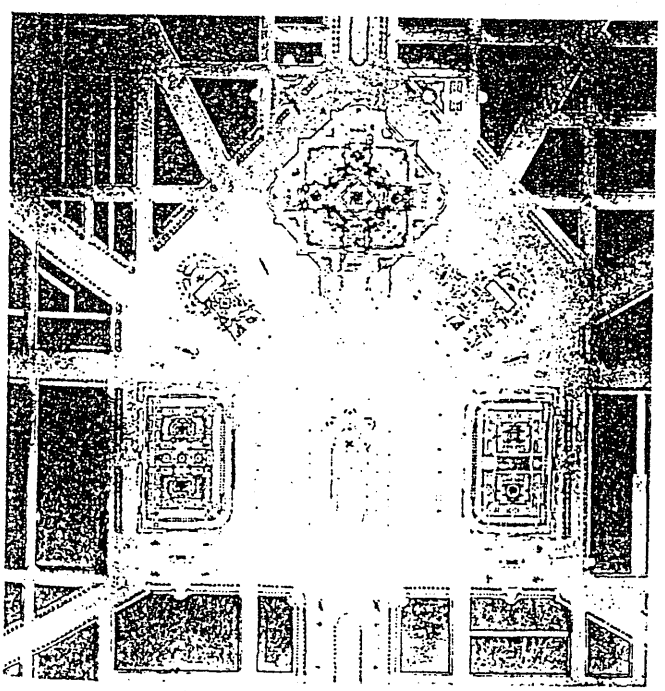


Fig. 14: Chicago's Civic Centre: plan and perspective

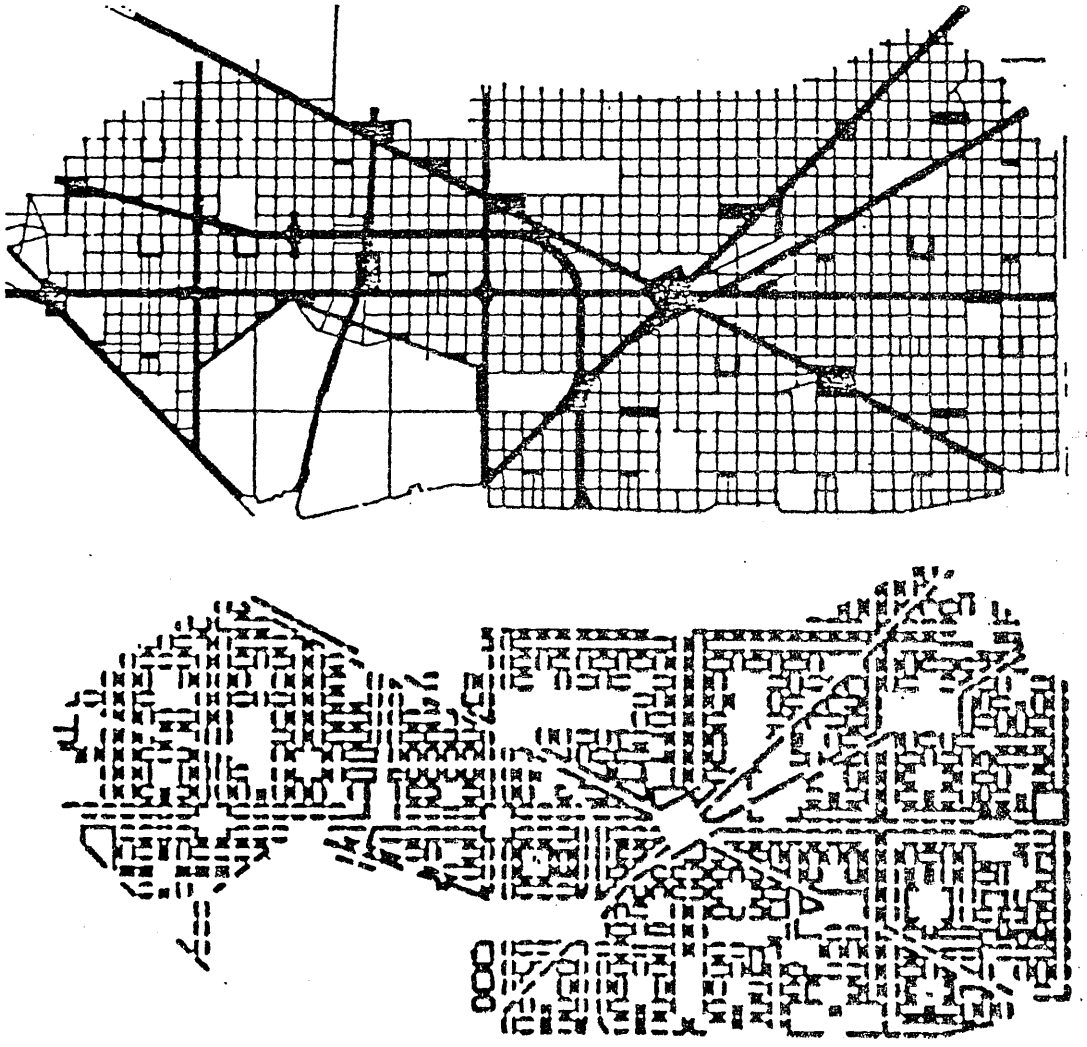


Fig. 15: Barcelona: Urban form maps

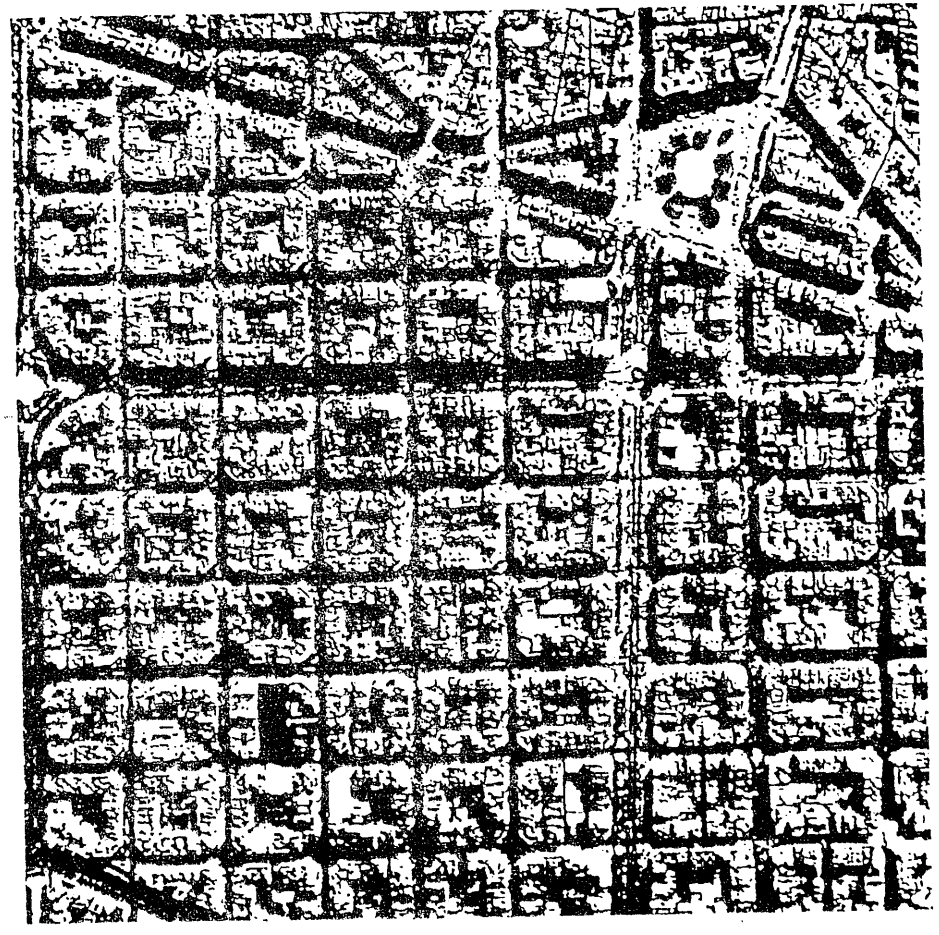


Fig. 16: Barcelona: Aerial view of Cerda plan

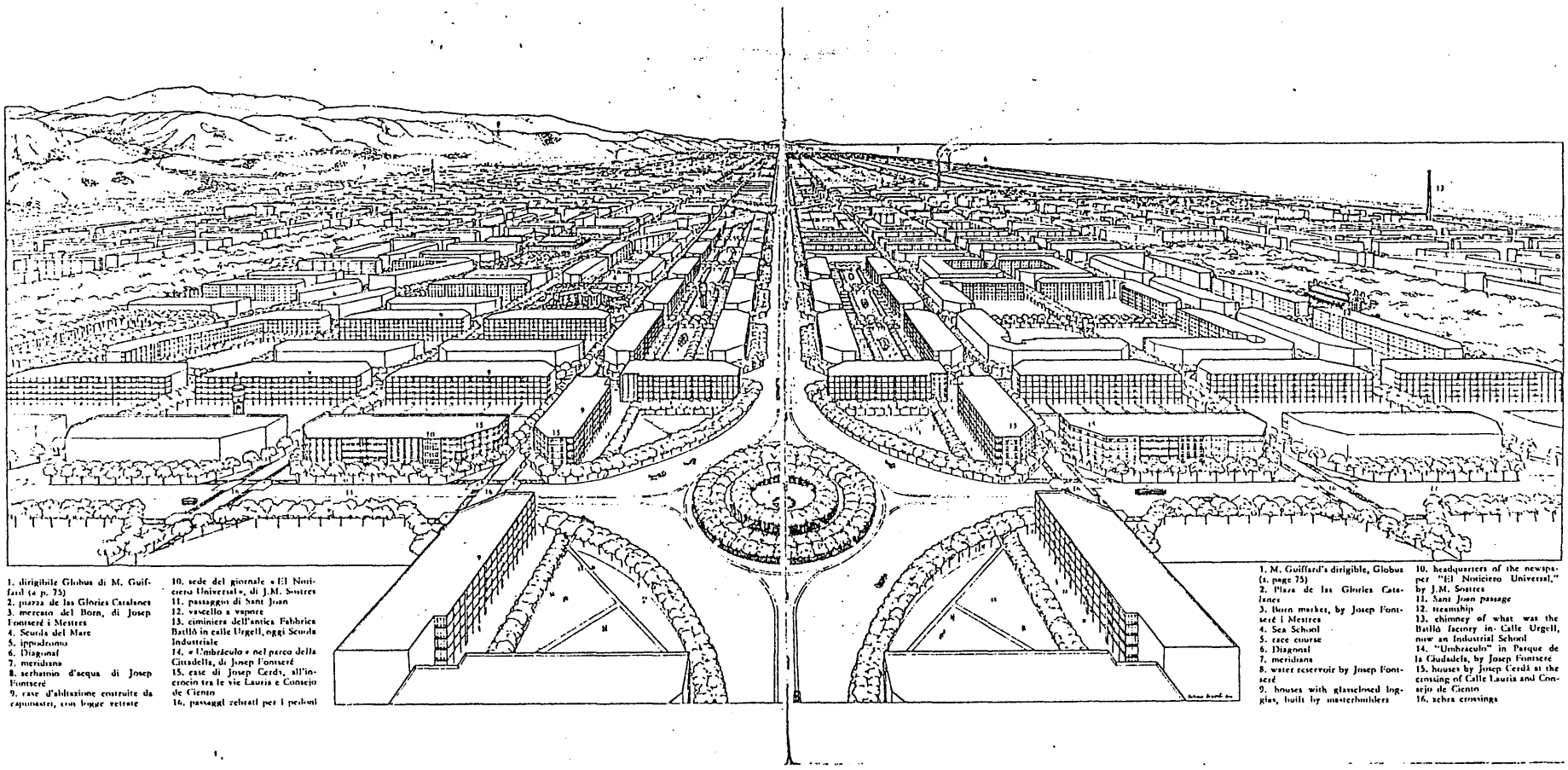


Fig. 17: Barcelona: Perspective of Cerda plan

area within a system of universal road traffic to establish communication between different towns and villages"(10). He established also a hierarchy of transportation by separating main roads " via transcendentales" from local streets.

The streets have all the same width and he defined the concept of equal width of streets for all streets in that

> "this was one of the variables, which most directly influence expropriation... The efficiency of traffic, the prieces of building areas, and lastly the solubrity of housing" (11).

The diagonals and boulevards are not the creation of Burnham or Cerda, but they are the most important features of the Baroque network. First conceived by Hausman in Paris for military purposes due to their ability to provide for easy troop movement, then by Pierre Charles L'Enfant in Washington as major streets wide enough to carry arterial traffic (Fig. 18, 19).

In Glasgow, most streets have the same width (Fig. 20, 21) t here are no major streets, although some have a higher priority due to the activities they contain, especially shopping. Even the ring road, which contours the city centre, seems not to solve local traffic problem; it carries through traffic at a strategic level. Therefore, Glasgow seems to have the greatest congestion situation in terms of traffic. In addition the grid is small which results in large numbers of traffic lights at control points. However, the hierarchy of transportation could be achieved by segregating through traffic from local traffic:

- Fast grid carries fast and through traffic with long intervals between controls with few intersection.
- Slow grid carries local traffic.

The diagonals of the grid (Fig. 22) have apart from servicing

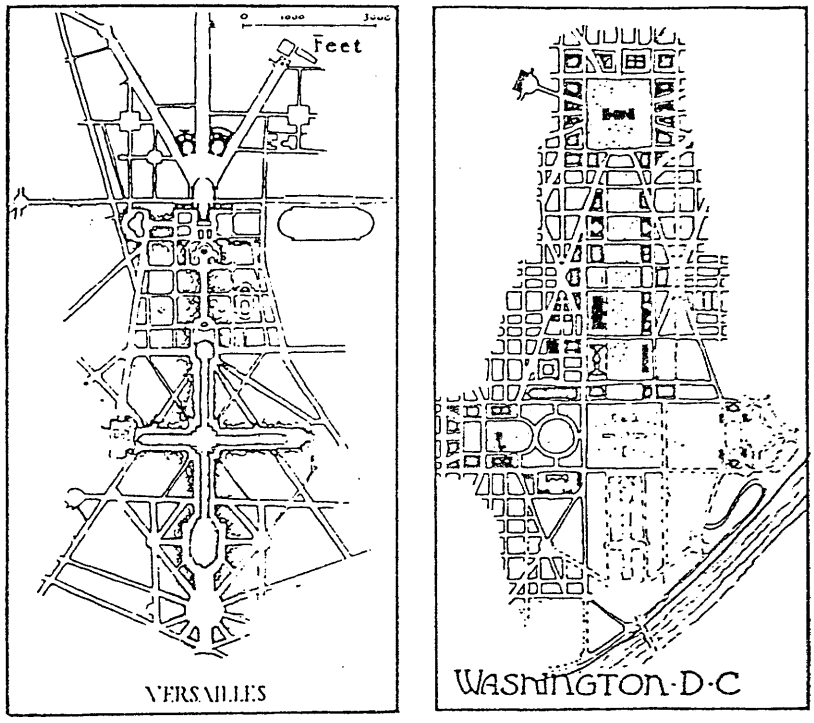


Fig. 18: Main axis of Washington D.C. and Paris

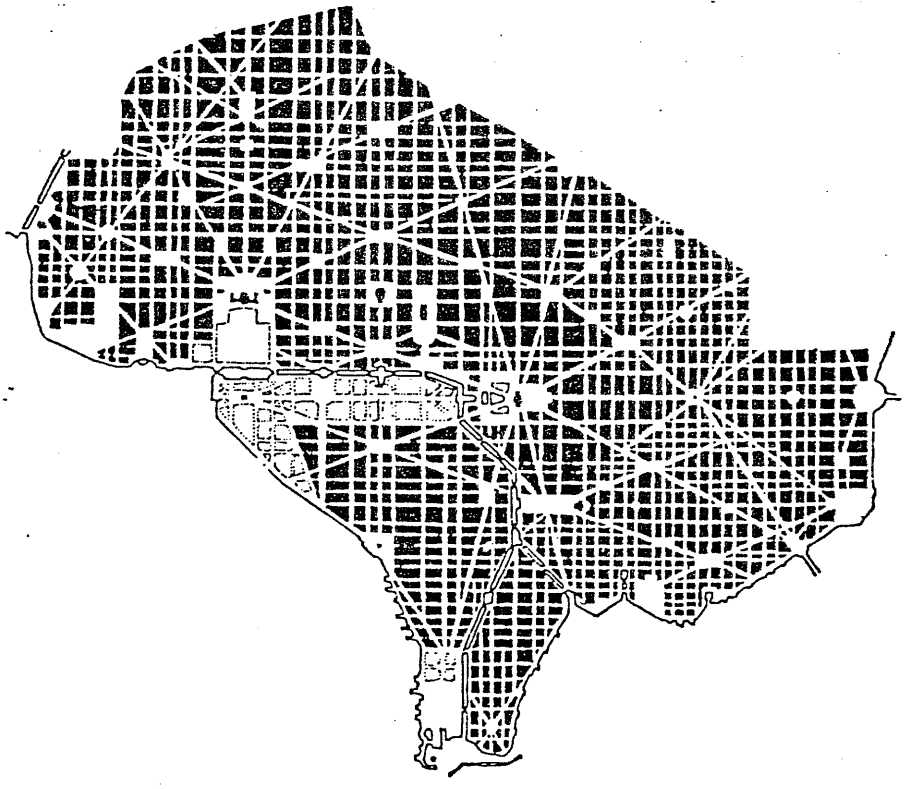


Fig. 19: Washington D.C.

Fig. 20: Glasgow: Urban form maps

advantages, urban qualities. They break the rigidity and monotony resulting from the repetition at the grid module and create dynamic and active urban space. But they have disadvantages too in the form of angular sites at corners of blocks.

Christopher Alexander proposed another grid called exagonal grid (12) (Fig. 23). It adds two more directions to the grid. But it seems to be theoretical and its efficiency in practice is yet to be proved.

1.2.1.3 Conflict between Pedestrian and Car

Following the arrival of the car, the street has gradually been taken from pedestrian and donated to the vehicle. It has become a means of circulation only and lost its character which was consistant within meeting place. "The street is not only a space of distribution and orientation but as space of economic and social exchange." (13) However, segregation between the pedestrian and the car is a means of redressing the balance. Various solutions have been developed to segregate the two types of traffic. Le Corbusier was one of the first to segregate entirely pedestrain traffic from motor vehicle traffic in his plan for "la ville radieuse" and Algeries (Fig. 24, 25)

Another attempt was made in 1930 for New York City. (14) The principal recommedations were to segregate the two types of traffic and to increase street traffic capacity by widening streets. (Fig. 26)

In Chicago, a proposal (Fig. 27) was made and aimed at

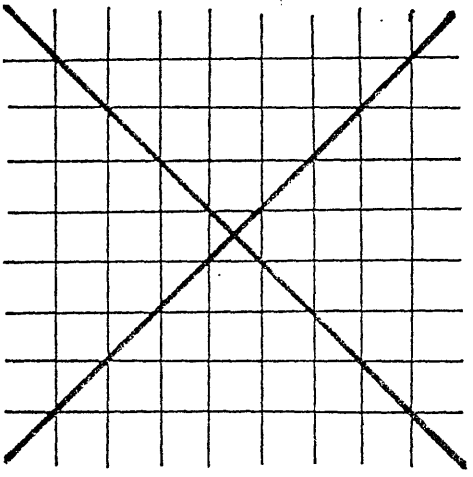


Fig. 22: Diagonals within a grid

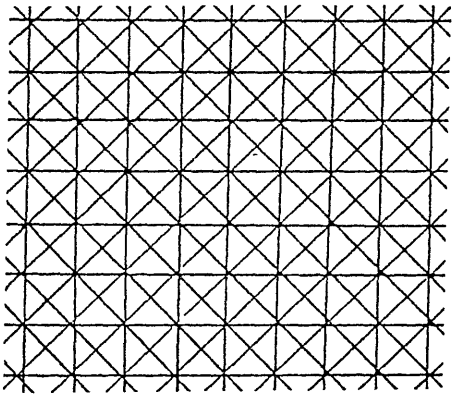


Fig. 23: Exagonal grid

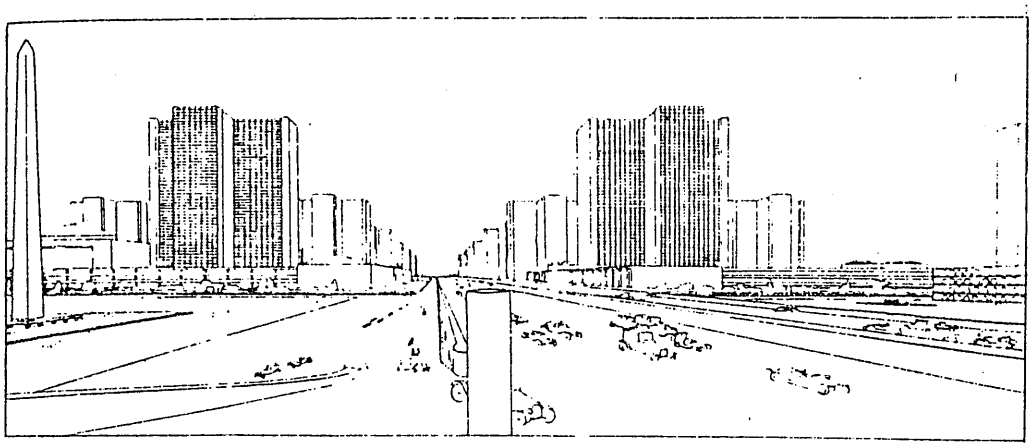


Fig. 24: "La ville radieuse", Le Corbusier

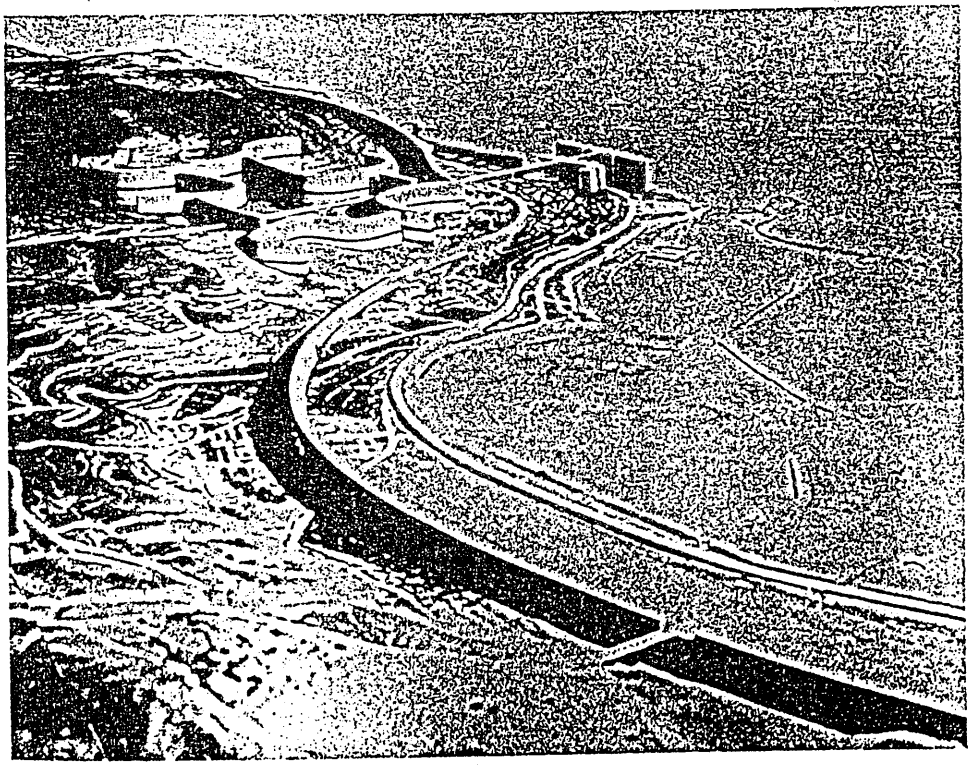


Fig. 25: Algiers plan, Le Corbusier

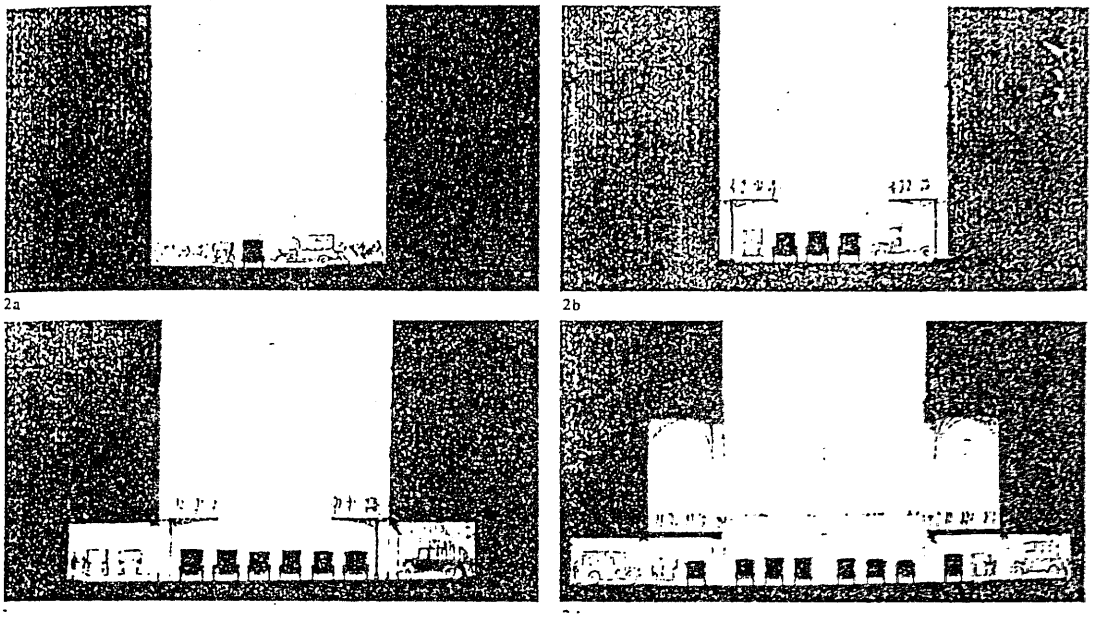


Fig. 26: Proposal for New York City to increase street traffic capacity

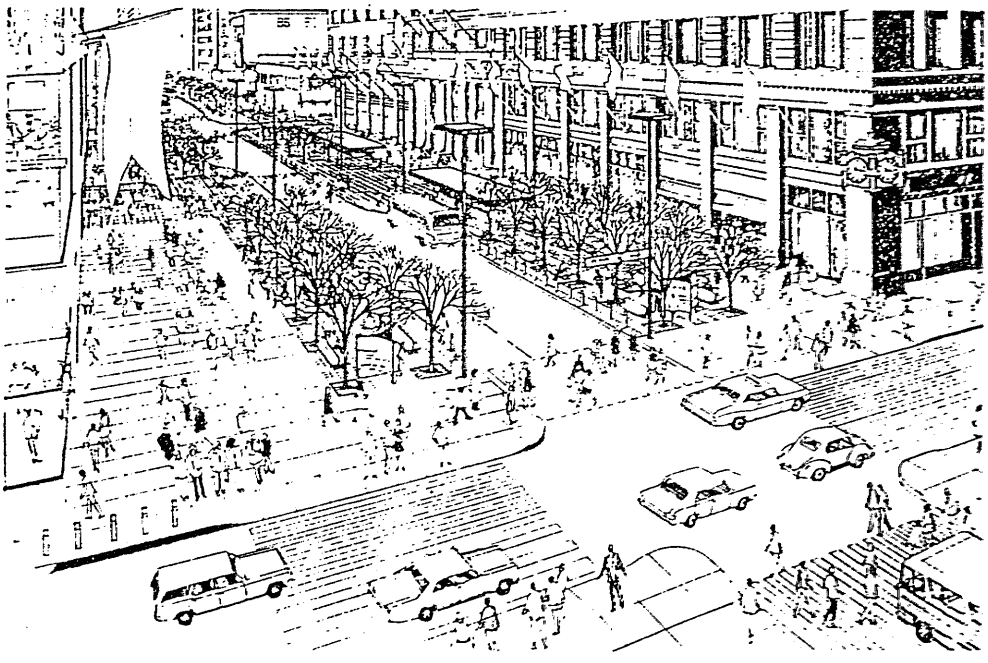


Fig. 27: Chicago: proposal to convert state street to pedestrian transitway

segregating entirely pedestrian and public transport from the other types of transportation. The street is completely pedestrianized except at Middle where public transport is allowed. The pavements are wide enough and trees are planted to separate pedestrians from buses and to create a pleasant urban promenade. The human proportions are restored and the street is becoming a social space.

But in Glasgow the pedestrian area is limited to the -Z- shopping streets (Buchanan Street, Sauchiehall Street and Argyle Street), and the car still dominates the streets of the city centre. One of the most interesting parts of Glasgow is the Civic Centre around George Square. It contains the most important urban features. George Square seems to be an island of traffic. The central public space is isolated. The car has killed the human life and destroyed human dimensions and proportions.

1.2.2 New Material and the Elevator

The 19th Century builders had only stone, brick and wood to choose from. Therefore, the result was a limited range of building details which created visual unity. However, the limitation of available materials restricted severely what individuals could do to disrupt the urban fabric, whereas the greater variety of materials (concrete, glass, frame steel, etc.) make it possible a larger variety of design form and each new material evokes its own form, details and pattern. The development of new materials and the elevator, made it possible

to construct higher structures. Both developments resulted in close grouping of tall buildings from which resulted a greater concentration of activities, people and traffic. Their effects on the physical configuration of the grid were in two ways:

Scale

Density

1.2.2.1 Scale

Originally the relationship between the height of buildings and the width of the streets were based on human dimensions.

Traditionally in Glasgow the streets were limited to 60 feet /18 metres and the height of buildings limited to 52 feet /15.5 metres. The buildings were about three-four storeys. (14)

In Barcelona, the same proportions were to be found. Cerda defined an equal width for all streets, 66 feet /20 metres. At the beginning of the development of the "Ensanche" in 1868, the first project to be built was the building of 211 dwellings. The dwellings were limited to two storeys with common partitions, conceived as terraces with back gardens. (15)

In Chicago, the streets were laid out on the famous 66 feet/ 20 metre and the service lanes on 16 feet / 5 metres. In the Chicago plan of 1909, Burnham recognized technology (new material and new construction techniques) and utilized it. He limited height of buildings to 14 storeys (140 feet / 73 metres). (16)

But the limitation of height in the three cities was short-lived and could not resist commercial pressures. Buildings in the city centres went up to many storeys therefore the balance between height and width was destroyed.

In Glasgow, buildings went up from 3/4 storeys to up to 8 storeys.

In Barcelona, from the original storeys to up to 9 storeys.

In Chicago, from 14 storeys to up to 100 storeys which represents the most dramatic change of the spatial configuration

of the grid.

These new proportions transformed the street in the grid into wells for going through. The balance, street- building - plot, was completely destroyed. The new situation led to a renewed concern in townscape design, and to reactions from the urbanist of modern architecture, especially Le Corbusier. His concern was to restore this balance and to get away from what he called "le rue corridor" (Fig. 28) by suggesting new development of the grid by which he created spacious streets at human dimensions. He also broke the long distance of buildings and plots and conceived shorter ones to break the monotony resulted from greater buildings and plots. (Fig. 29)

However, many attempts have been made to restore this balance (street- building and plot). Two by Le Corbusier and one by Sir L. Martin. Le Corbusier, when he paid a visit to New York in 1935 said "What about the road?" (17) and proposed a new development (Fig. 30). He also suggested a new scheme for Barcelona in 1934 (Fig. 31). The two schemes, apart from their townscape purposes, aimed at the increase of street capacity by widening the street. In the same spirit, Sir L. Martin suggested by a mathematical analysis, a scheme by which he proved that Manhattan Island could be built on only seven storeys and yet maintain the same area of development (18) (Fig. 32).

But neither Le Corbusier or Sir L. Martin could prevent such a development. The grid by its limited size allows for a higher development on the same area without a need to develop servicing networks. The great commercial pressures could only

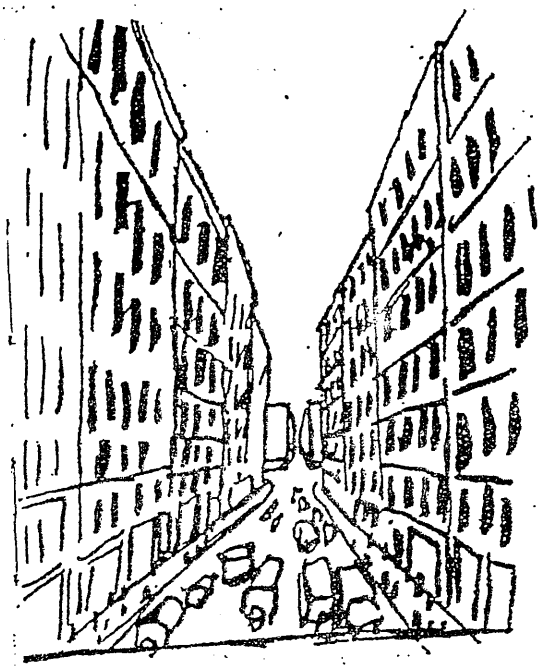


Fig. 28: "larve corridor", Le Corbusier

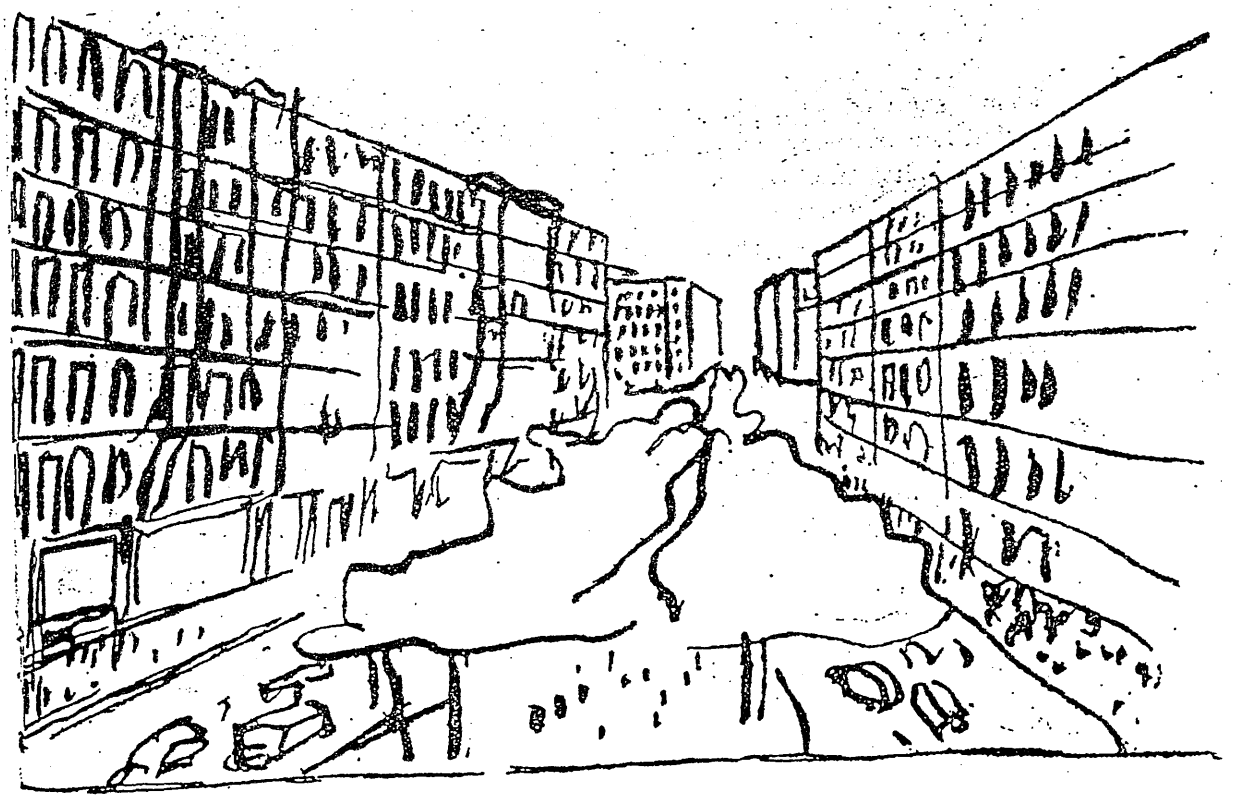
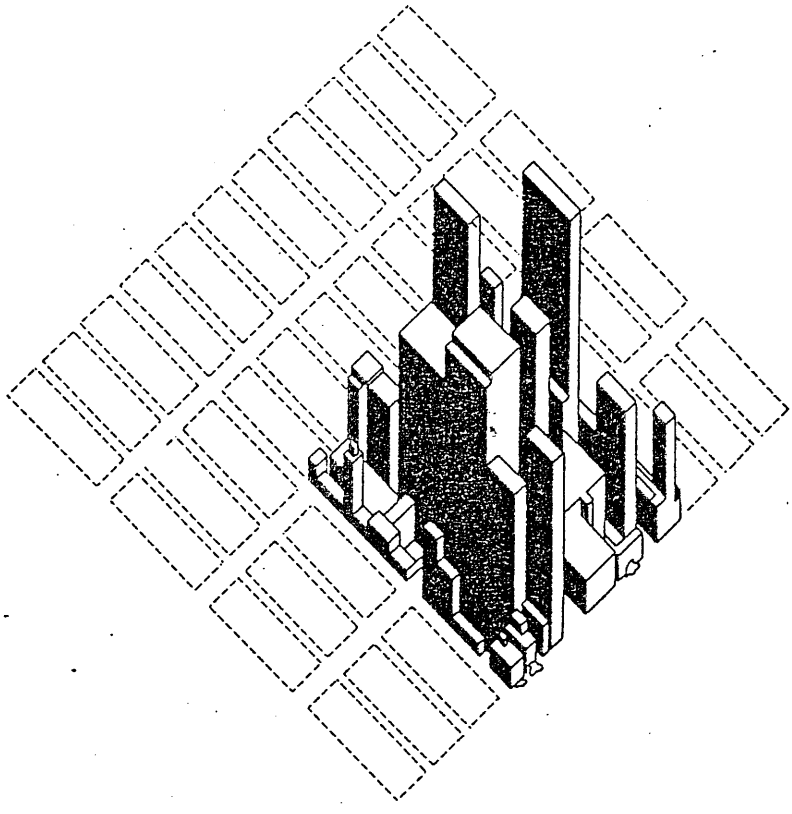
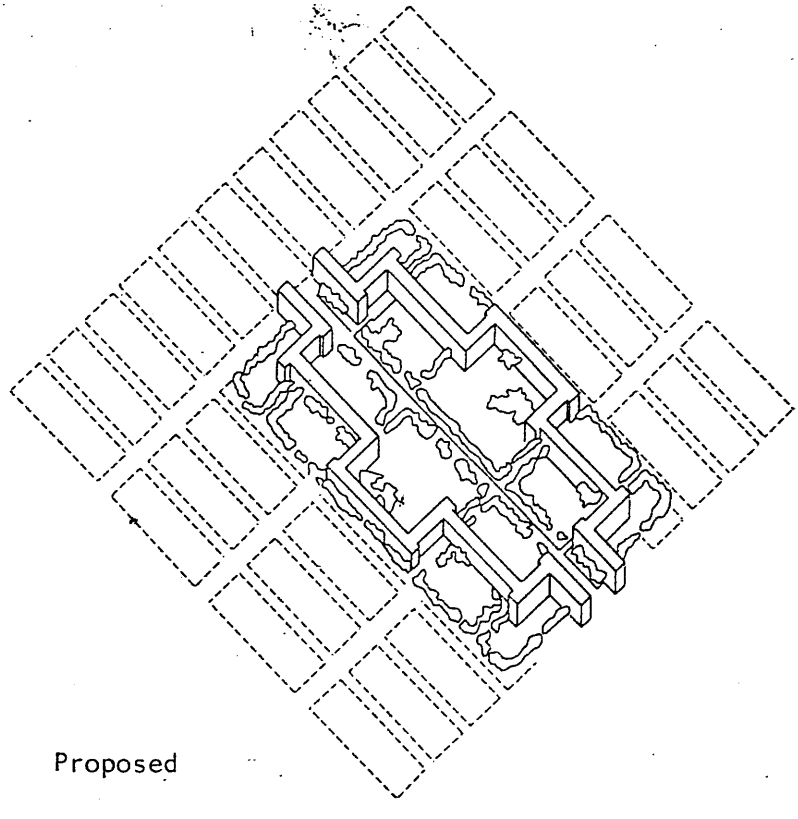


Fig. 29: Le Corbusier's proposal to restore the balance (street-plot-building)



Existing situation



Proposed

Fig. 30: Le Corbusier's proposition to redevelop New York's grid

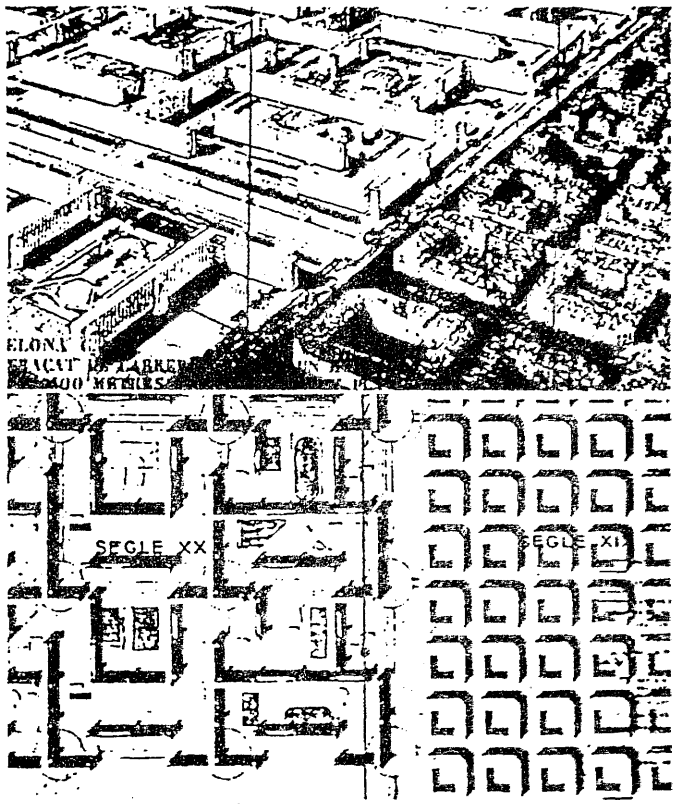


Fig. 31: Le Corbusier's proposal for Barcelona grid

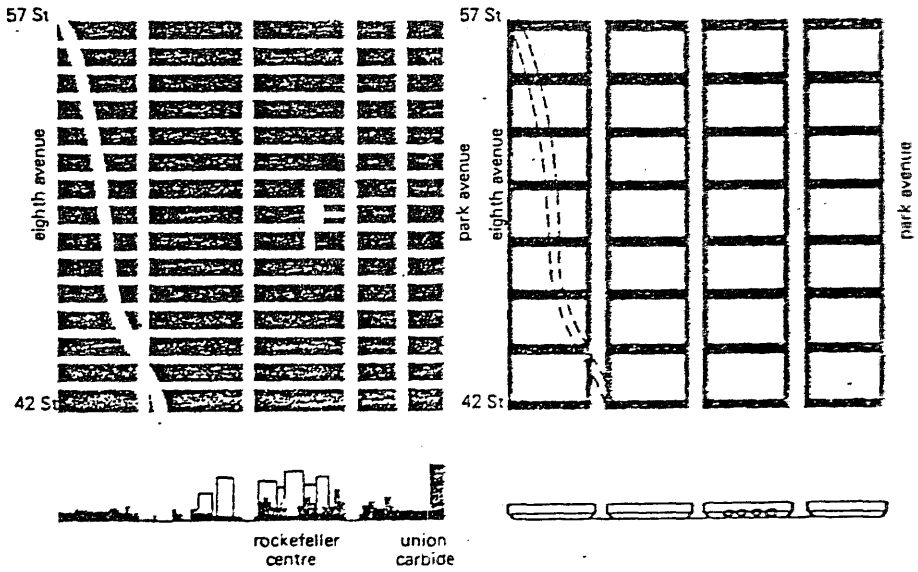


Fig. 32: L. Martin's proposal for New York

be solved by the maximum exploitation of floor space and by tall buildings. Tall buildings are symbolic of commercial prestige and they represent attractive and commercial focal points as meeting spaces where commercial contracts are to be concluded.

1.2.2.2 Density

As we have seen, the high density created by technological change was without precedent. It produced an intensive form and maximum exploitation of the plot. From this resulted a great concentration of activites which attracted more people and traffic, it therefore affected mostly accessibility and the contact between buildings and public spaces.

The rectangular or square shape of the grid plot offers more accessibility. The two shapes are most accessible and give most contact after the circle (Fig. 3.3) but they are more flexible than the circle which is difficult to be assembled in multiples.

The accessibility depends also on the size of the plot and the capacity of exploitation of the urban ground. The smaller the block, the more accessible it is. "The size of the block defines the quality of urban pattern", and "the density of the street pattern is the key element to the urbanity of a street". (19) Leon Krier, in his project for Barcelona shown before, refused the original block and subdivided it into smaller units in order to give more contact between buildings and streets and to make it more accessible. From streetscape point of view, the small block gives variety and rhythm to the urban facade whereas the long block creates monotony. Thus the size of the block defines a plot width which is very important in the quality of the streetscape.

In comparing the three grid plots of the three cities: Barcelona, Glasgow and Chicago, Glasgow's is the smallest which makes it the most accessible(see Fig.9). In Barcelona, the plot

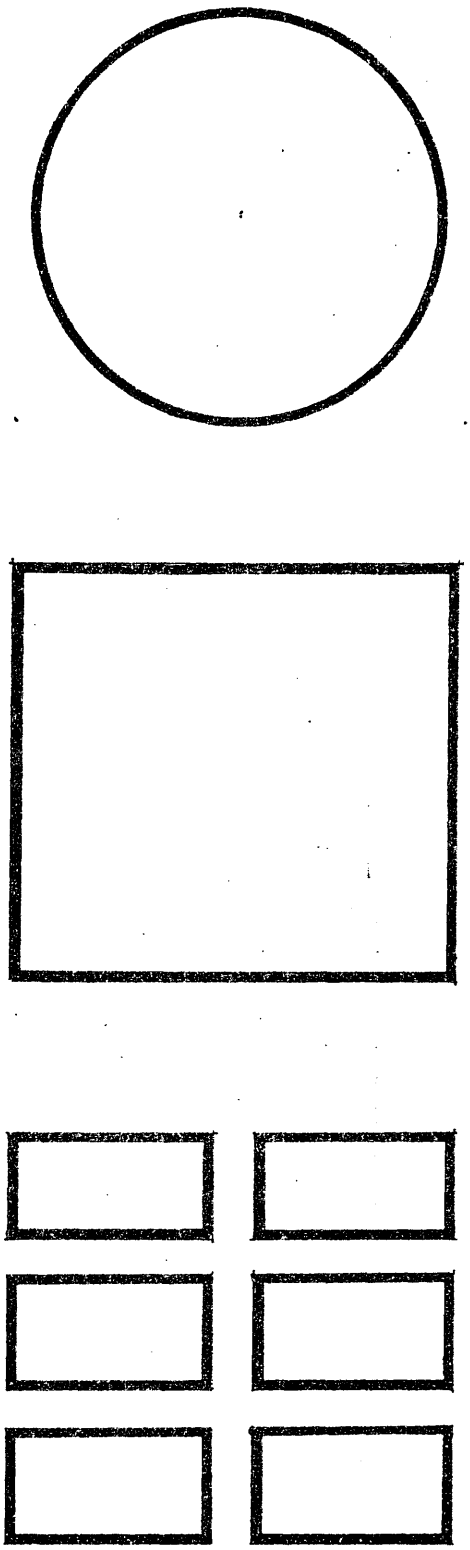


Fig. 33: Shape and size determine capacity of accessibility

is relatively small but L. Krier (20) found it long and divided it into smaller units (24 m) giving more accessibility and more variety in streetscape (Fig.34). In Glasgow the block perimeter is broken by a service lane of 16 feet / 5 metres. In addition to climate reason, the service lane makes the block more accessible. The blocks are classified according to the interior space (Fig. 35).

- Public space as ordinary service lane
- Semi-public space as courtyard which communicates directly with public space (street)
- Private space as deadend, therefore the interior space is reserved only for the inhabitants of the block.

In Barcelona, the blocks usually enclose a courtyard used as private space (garden) (Fig. 36). The density of the block varies according to land occupation of the plot and the number of storeys of the block (Fig.37). This allows for flexibility to tolerate growth and change.

In Chicago, the block perimeter is also broken by service lane of 16 feet/5 metres. The nineteenth century development of the grid was not so intensive as the twentieth century. From 1923 until 1942, Chicago enjoyed a liberized zoning policy which did not allow buildings to be 264 feet/80 metres in height but also permitted above a tower not to exceed 25% of the lot area, not one-sixth of the volume (21) (Fig. 38, 39). The high density on a plot which is less accessible due to its size makes Chicago city centre, where accessibility is a lay element in the urbanity, the worst and the most confused situation.

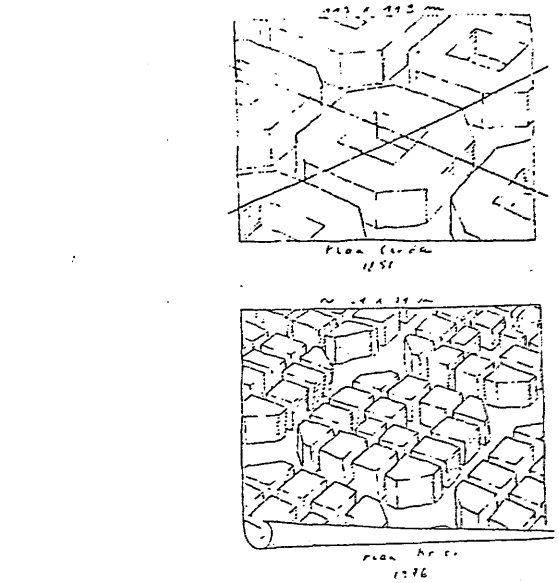


Fig. 34: L. Krier's project in Barcelona

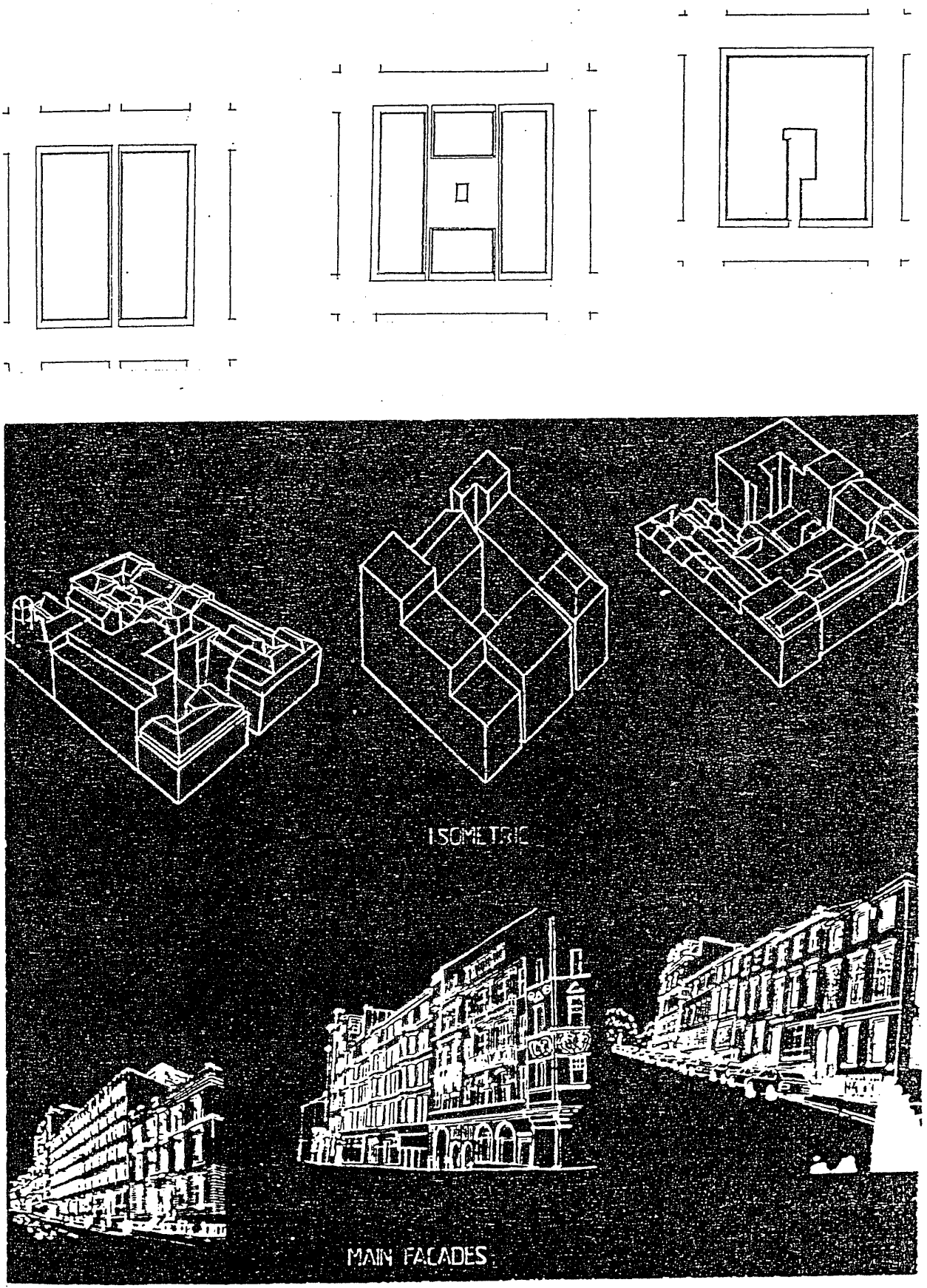


Fig. 35: Glasgow: Blocks classification

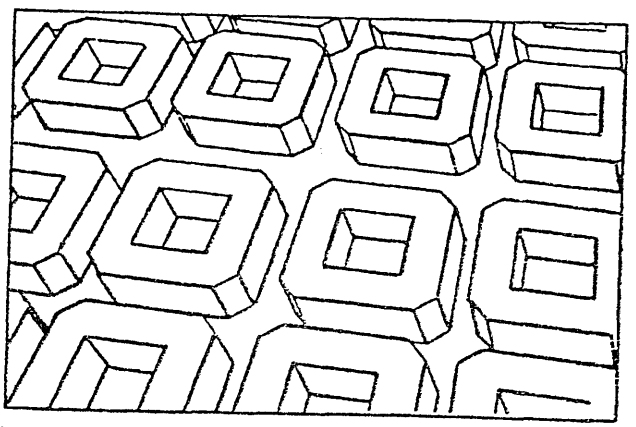


Fig. 36: Barcelona: Blocks are organized around courtyards

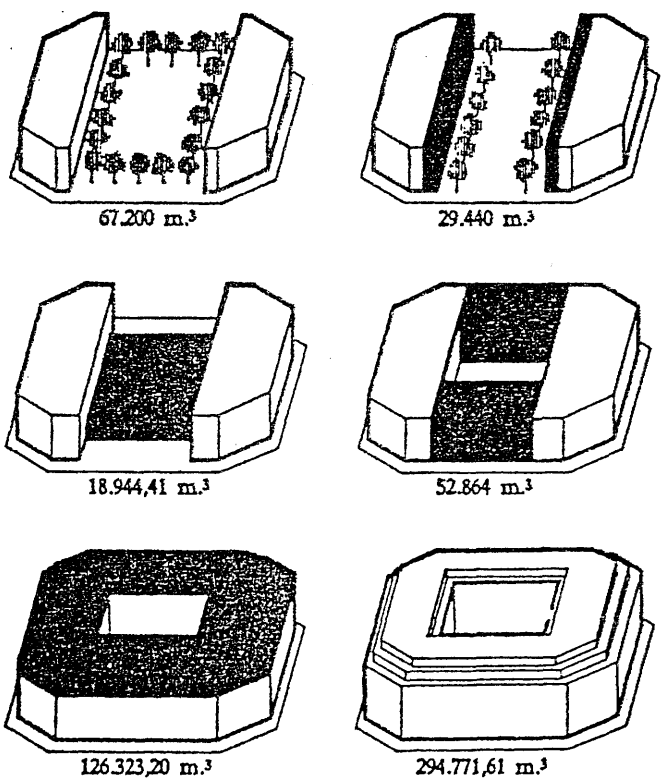
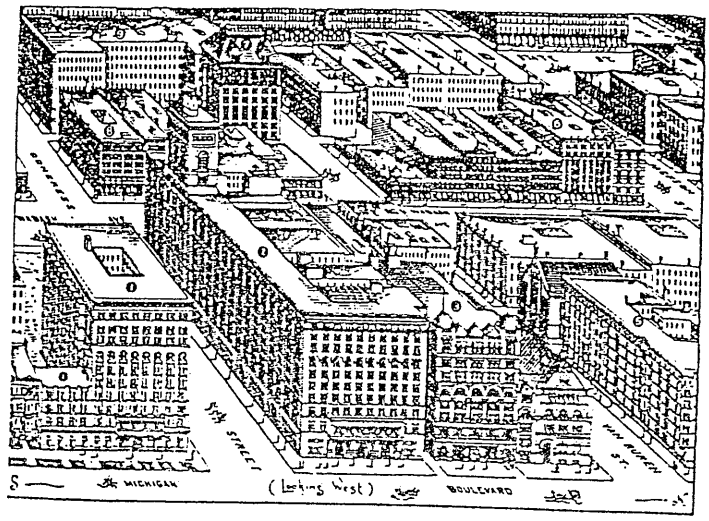
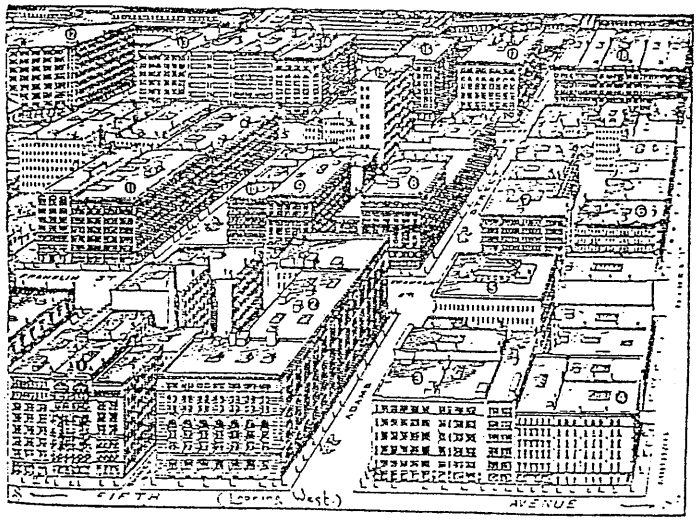


Fig. 37: Barcelona: Densification of the block





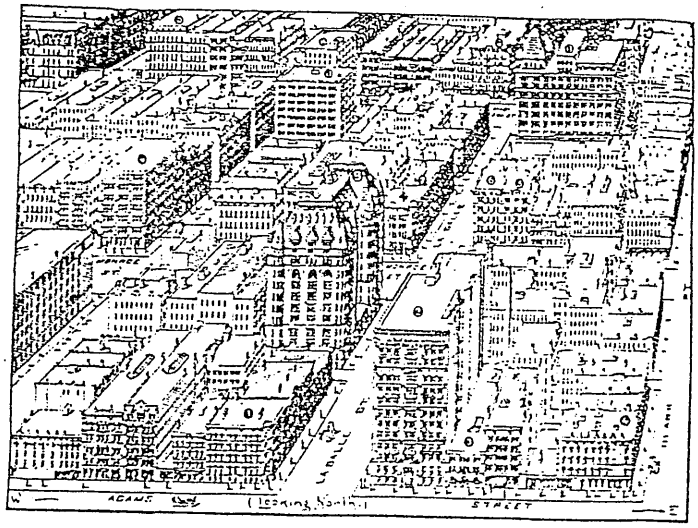


Fig. 38: Chicago: 19th Century development of the grid

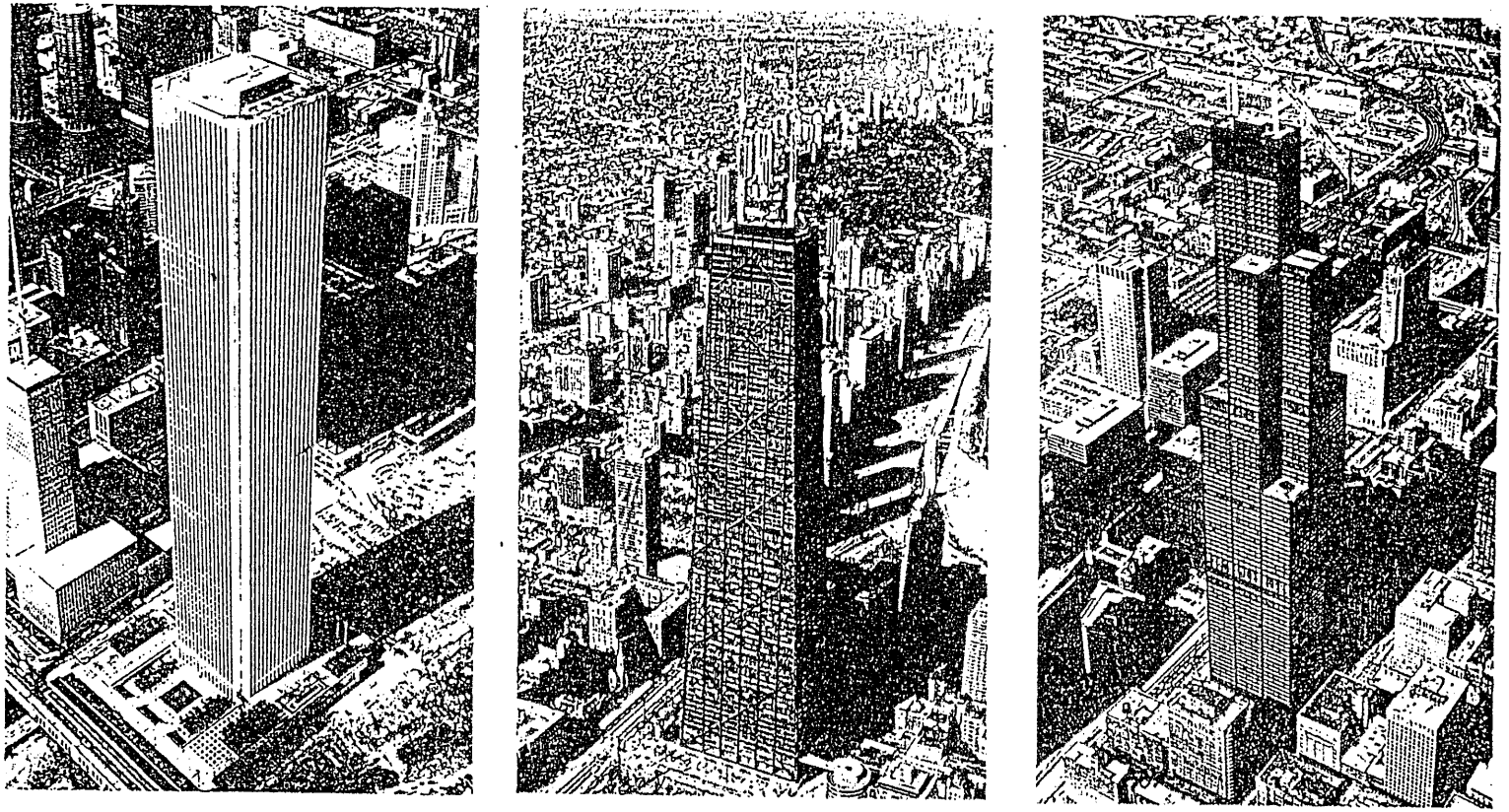


Fig. 39: Chicago: Intensive 20th Century development of the grid

So far, we have found that the plot or the grid module by its size defines the capacity of traffic and accessibility:

- The longer the plots distance, the more efficient is the mobility of traffic.
- The smaller the block, the more accessible it is.

  The small block also creates more interesting urban qualities and eliminates the monotony resulted from long distance of the plot.

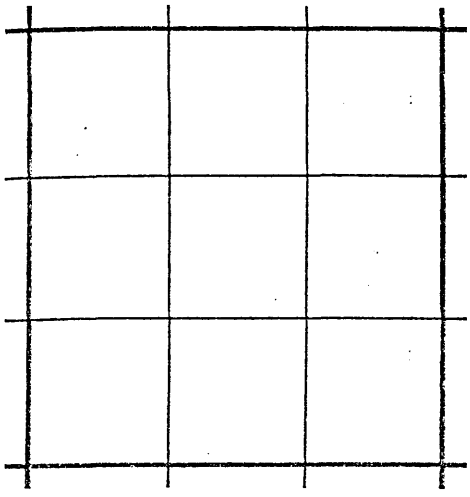
However, the concept of a grid within a grid may be the convenient solution which defines both sizes of the grid module:

- The big grid is for fast and through traffic (fast grid)
- The small grid is for local traffic (slow grid)

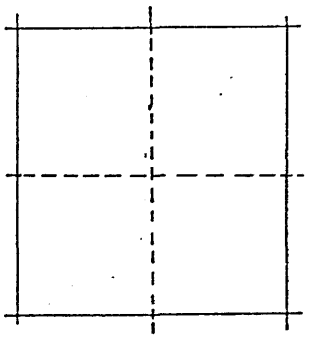
  It gives also more accessibility and better urban qualities.

  A secondary grid within the slow grid can be reserved for pedestrian and cyclists. (Fig. 40)

In the same spirit, Kevin Lynch (22) proposed a grid within a grid (Fig. 41) based on fast and slow grid.



Fast and slow grid



Secondary grid for pedestrians

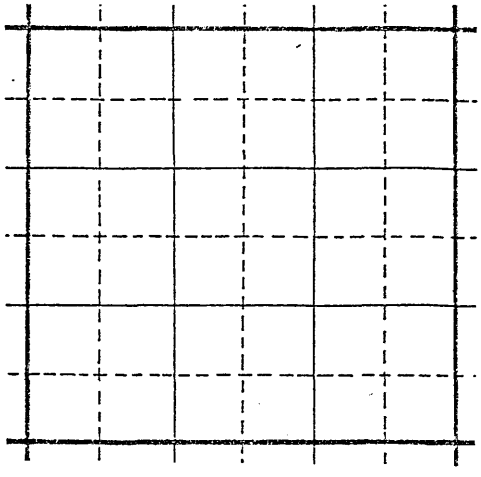


Fig. 40: A grid within a grid

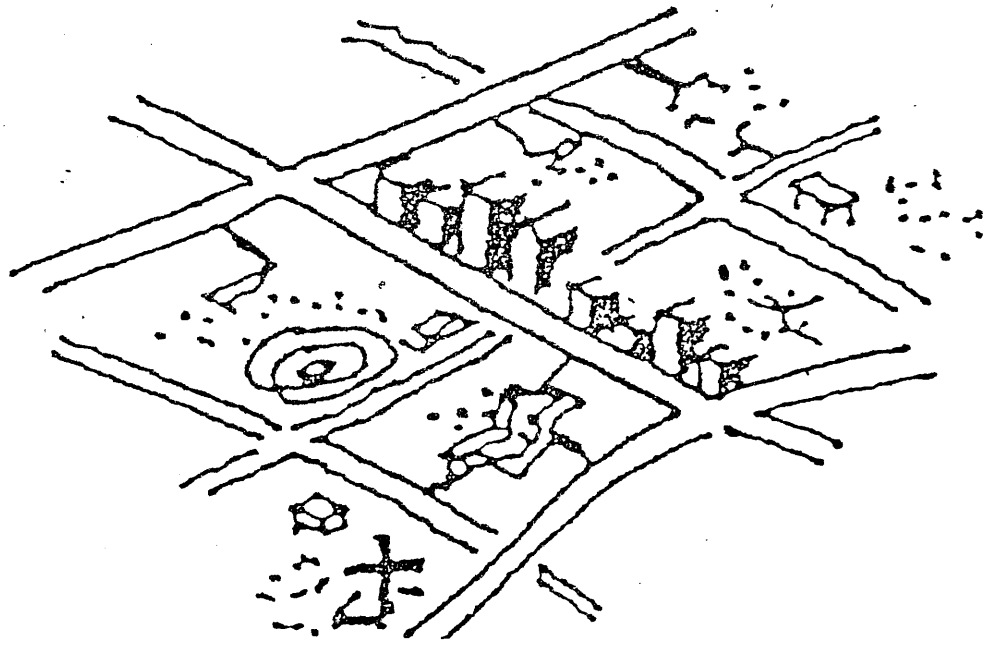


Fig. 41: K. Lynch's proposal

CHAPTER II : THE RELEVANCE OF THE GRID TODAY

1.2.3 Environmental Science Changes

Originally, the plot in the grid was laid out to respond to the climate. Its orientation was dictated by the need to mave maximum daylight and sunshine.

In Barcelona, Cerda insisted on the orientation of the streets (directory of the street line) and the exposure of the blocks. The position of the block (building) in relation to the sun is fundamental in order to exploit the sun's rays as fully as possible.

In his plan, the diagonals are pointed towards the four cardinal points, which gave the longitudinal streets of the "Ensanche" an orientation north-east/south-west. The longitudinal streets follow the coast line and the line of the foot hills of the limits of the Barcelona plan (Fig. 42). As a result, the block is orientated in such a way to have maximum exposure.(Fig. 43) The square shape of the block is very familiar in hot climate. The block enclosed a courtyard which is used as a green space to create micro-climate.

In Glasgow and Chicago, the plots are orientated east-west. (Fig. 44) The rectangular shape offers more exposed facade and more opening to allow maximum daylight to enter. The service lanes break the depth and allow more daylight as well.

With the enormous advance in technology of environmental sciences, especially lighting and ventilation, electricity

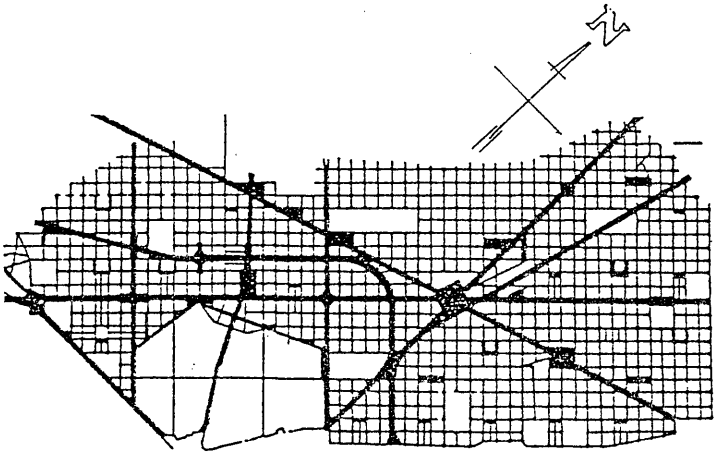


Fig. 42: Cerda's plan: diagonals pointed towards the four cardinal points

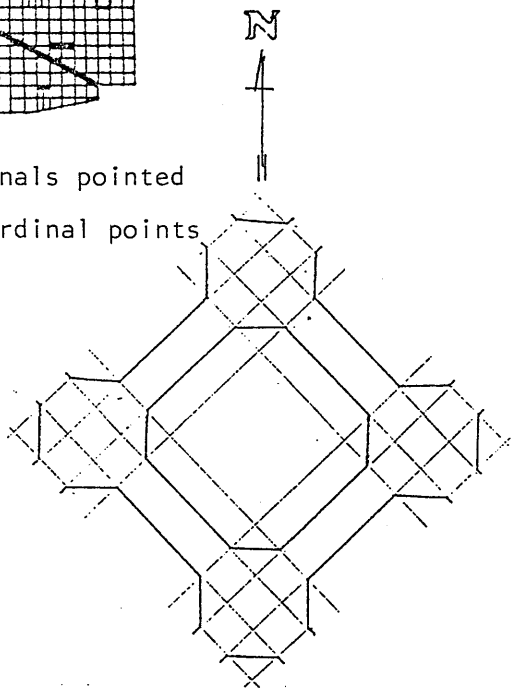
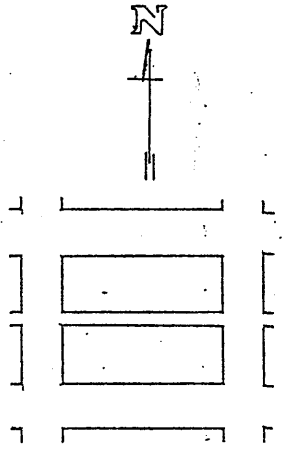


Fig. 43: Orientation of Barcelona's grid



Glasgow's grid

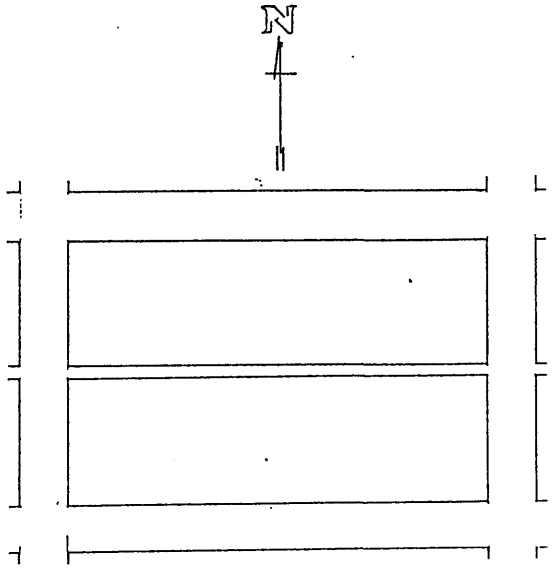


Fig. 44: Orientation of Glasgow and Chicago's grids

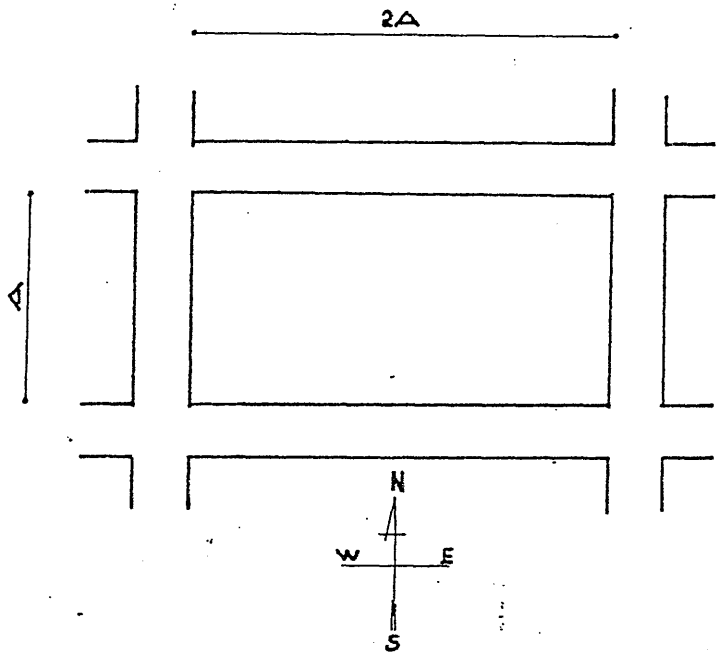
Chicago's grid

and artificial ventilation solved the problem of the interior space of the block which could be served without natural lighting and ventilation. The size of the block (depth) does not any longer depend on climatic factors, but from the psychological point of view, sunshine cannot be ignored.

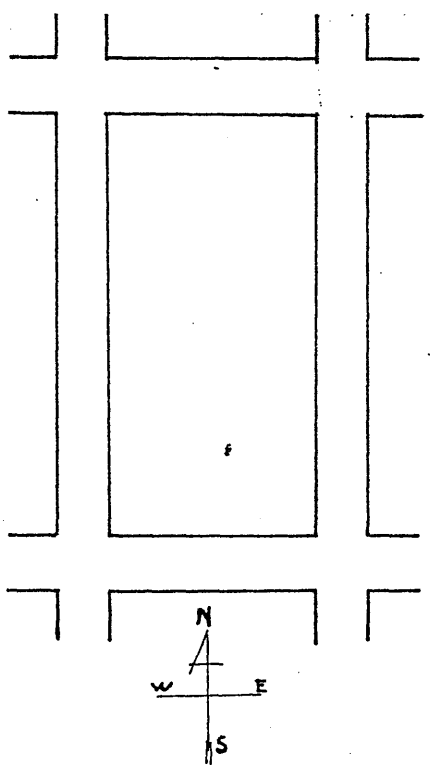
The orientation of the grid directly affects the period of sunlight experienced. Since the interior space of the block is not concerned, exterior space is more concerned with the sunlight. For instance, in Glasgow, the longitudinal streets are orientated east-west which prevents the south facade having any sunlight.

In summary, to obtain maximum benefit from the streets, the grid should be orientated north-south in cold climates for maximum sunlight and east-west in hot climates for having shade, (Fig. 45), ie. the opposite to the Glasgow and Chicago grids.

Fig. 45: Orientation of the grid according to the climate



Facade exposed to sunlight - 4A



Facade exposed to sunlight - 5A

CHAPTER II : THE RELEVANCE OF THE GRID TODAY

2. New Situation: Milton Keynes

2.1 Historical Background

Milton Keynes represents the latest British development of a long chain of town planning experiments starting with garden city movement, through three generations of new towns. It was a government decision as an answer to London's urban growth, and a new concept of a city which eliminated all negative components associated with the industrial city. Following many studies, the government decided to develop the new city which would accommodate people from both London and Buckinghamshire. Six goals were initially defined:

1. Opportunity and freedom of choice
2. Easy movement and access and good communications
3. Balance and variety
4. Creation of an attractive city
5. Public awareness and participation
6. Efficient and imaginative use of sources

As a result of the second goal, the basis of the design of Milton Keynes was devised. From the beginning, there was an emphasis upon easy movement and access on a large scale. The designers of Milton Keynes considered the city in relationship to the motor car as did Le Corbusier in "la ville radieuse" (Fig. 46, 47) and Chandigarh (Fig. 48, 49). Le Corbusier established a hierarchy of streets according to speed and type of traffic.

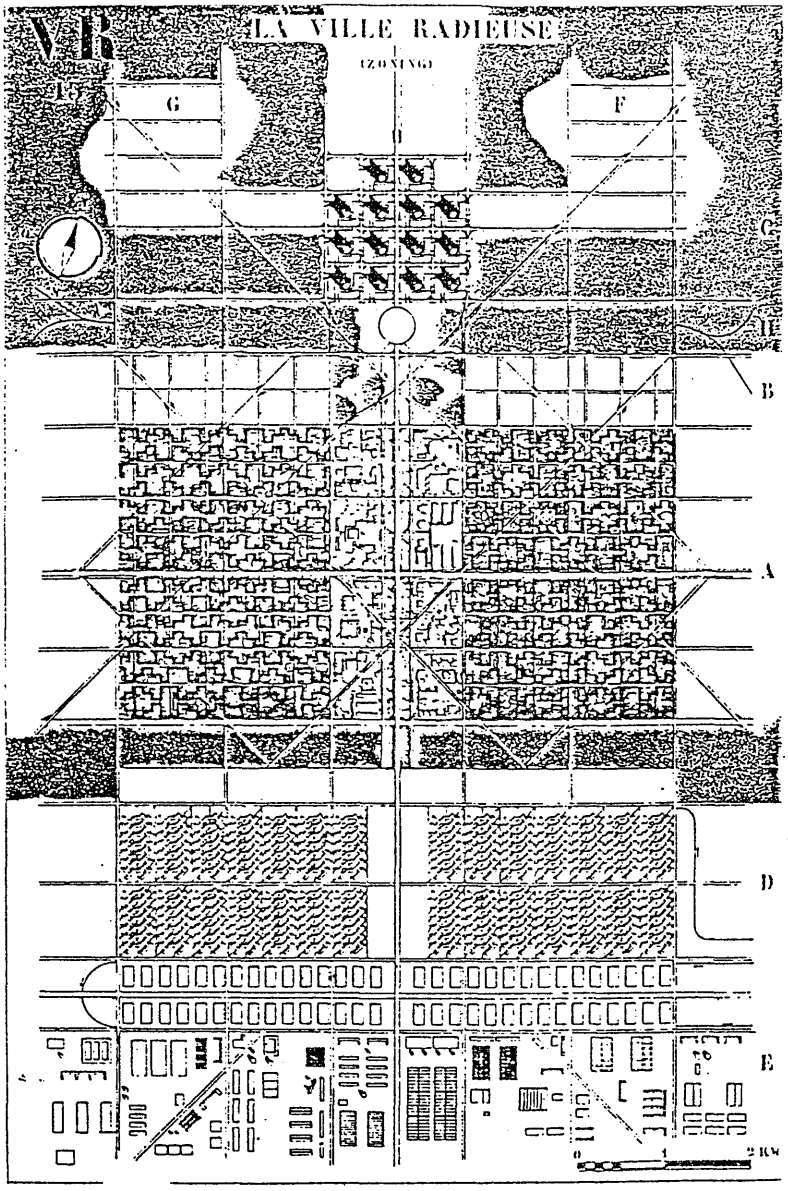


Fig. 46: "la ville radieuse" Le Corbusier

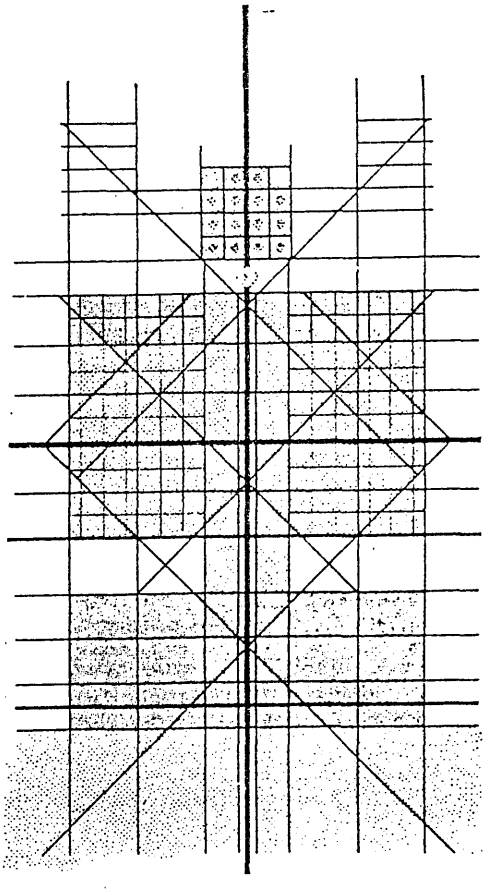


Fig. 47: Diagram of street pattern

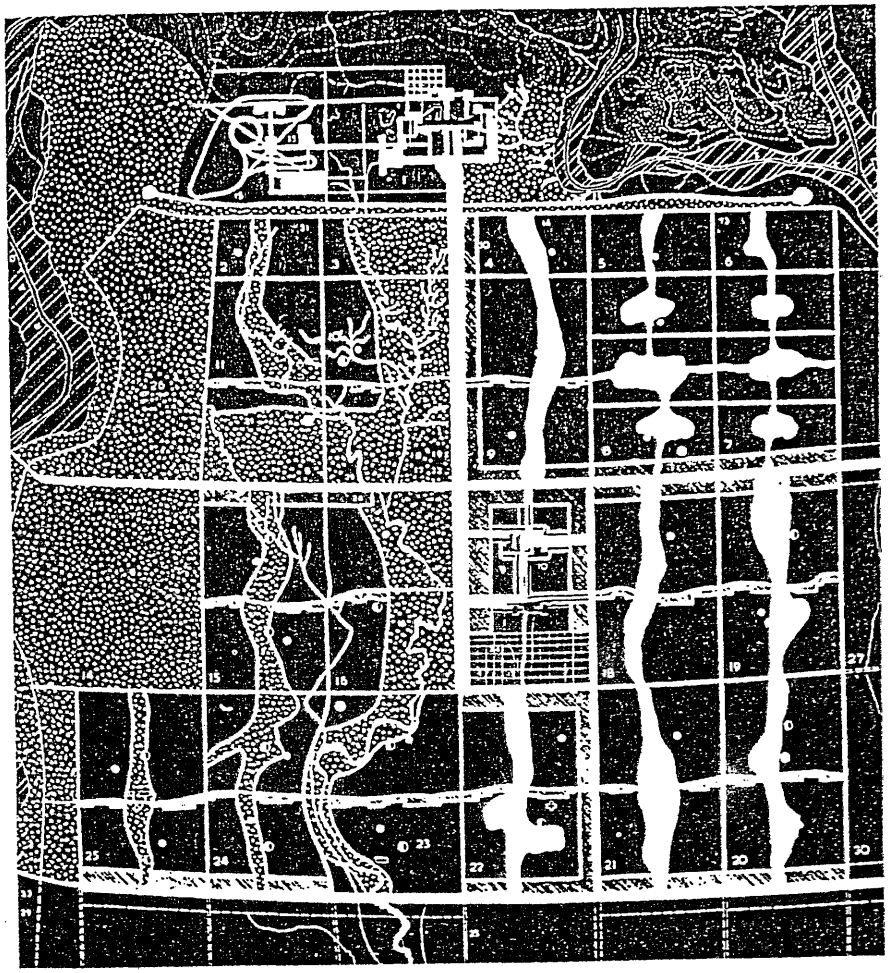


Fig. 48: Chandigarh, Le Corbusier

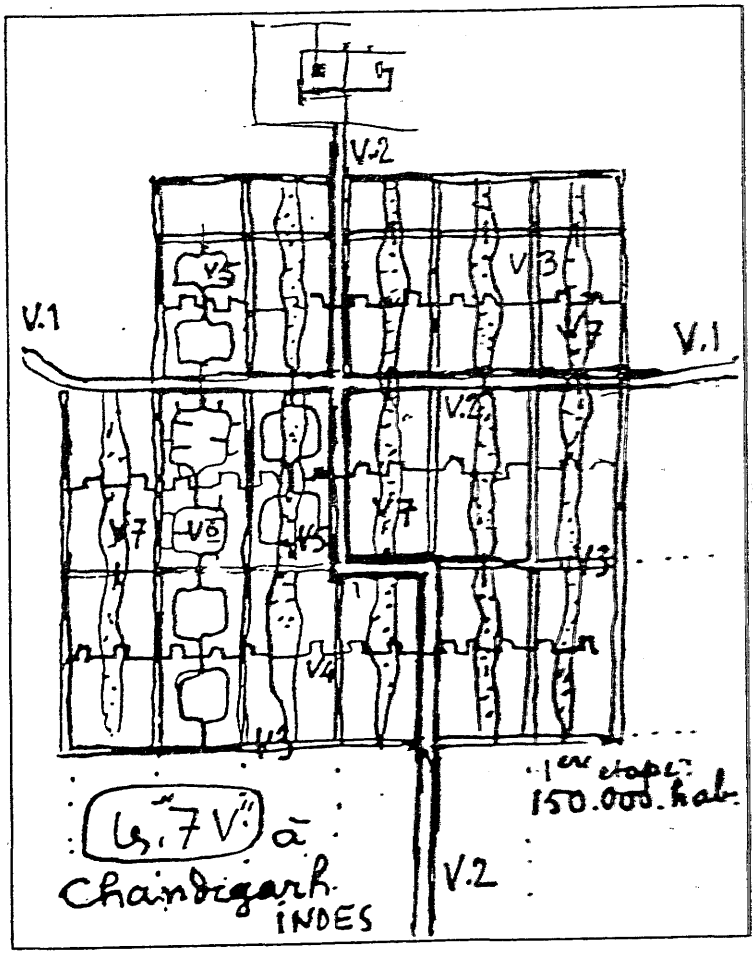


Fig. 49: Diagram of Street pattern

2.2. Hierarchial Grid

Milton Keynes was the twentieth century answer to the motor car. Easy movement and access dictated the urban pattern which is road system grid. The urban pattern was configureated into two ways:

2.2.1. Fast Grid

The road pattern of Milton Keynes is one of the most important in the city's design. It is an irregular grid with two lanes of dual-carriage ways intersection at approximately one kilometre centres. The roads run vertically and horizontally and curve to fit the topography of the site. This super grid is reserved for the motor and carries fast through traffic on long distances between two main controls. Control points are roundabouts which facilitate fast traffic and encourage safety. They are served by traffic lights which organize traffic movement. All the roads are equal to avoid priority on certain roads. (Fig. 50, 51)

2.2.1. Slow Grid

The fast grid module establishes a role of ring road within which is a secondary network which carries slow and local traffic within the city centre, (Fig 52). There is a change to a more formal road system grid which is rigid and regular with straight lines intersected at right angles. (Fig 53) There is also a secondary grid within the slow grid reserved for pedestrians and

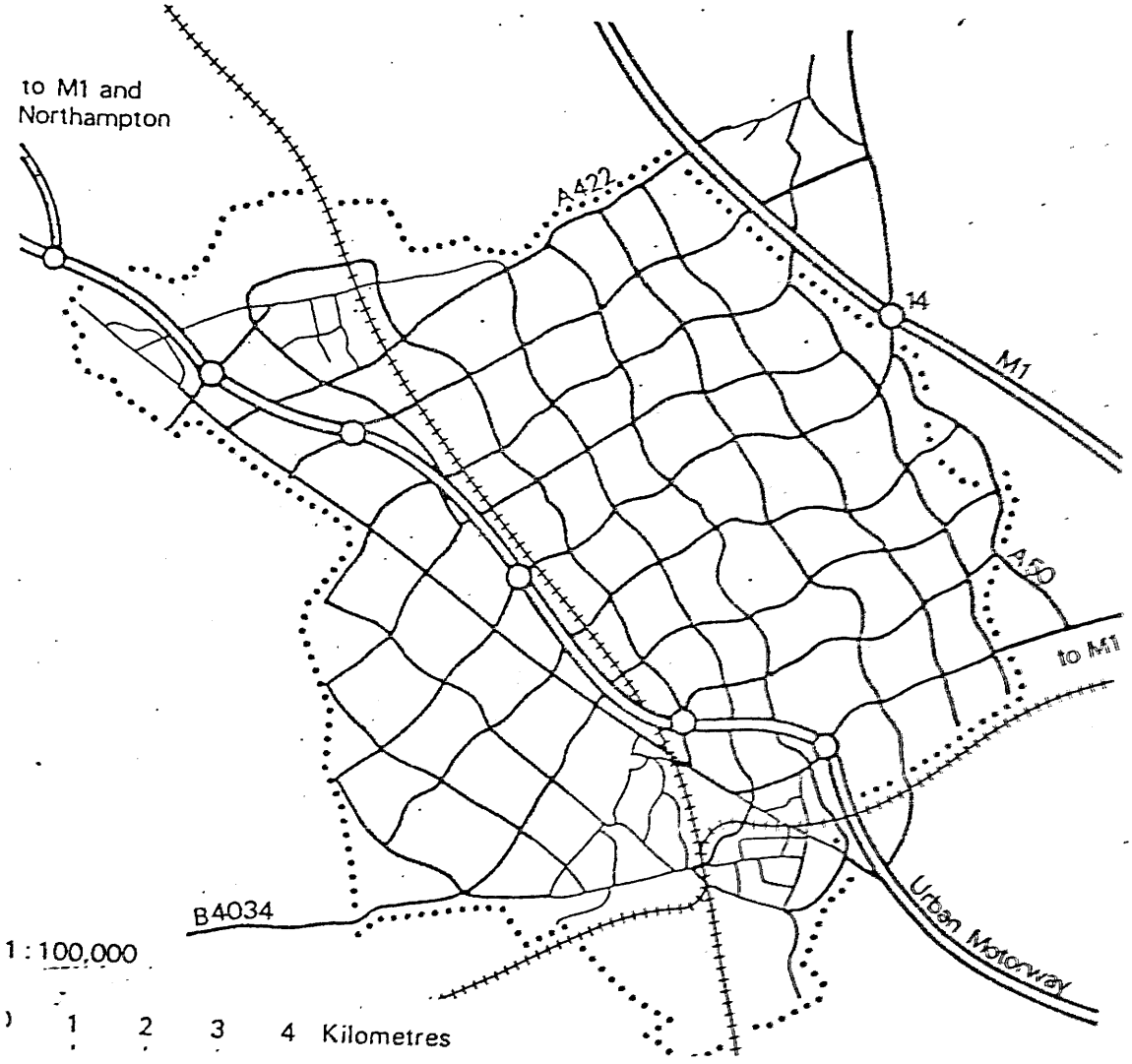


Fig. 50: Milton Keynes plan

Fig. 51: Sketch of Milton Keynes grid

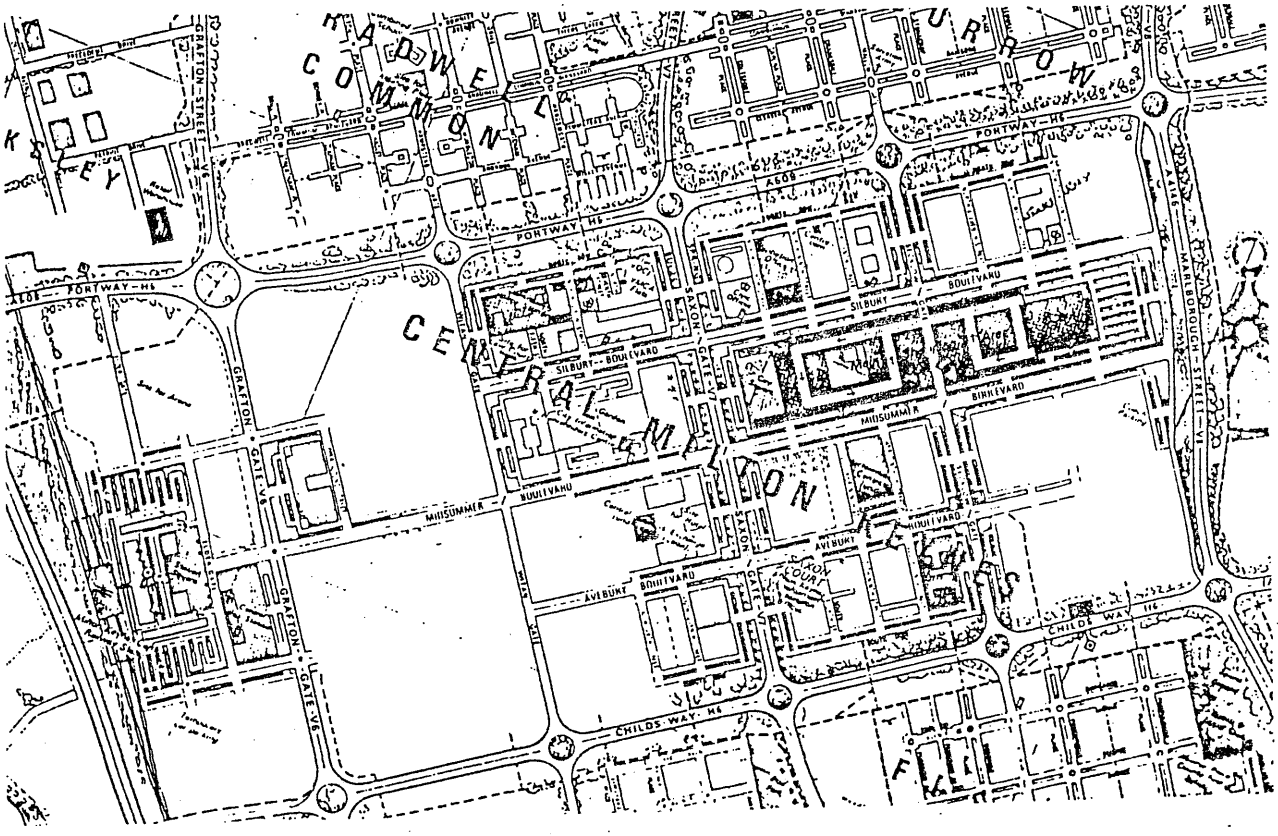


Fig. 52: The City Centre of Milton Keynes

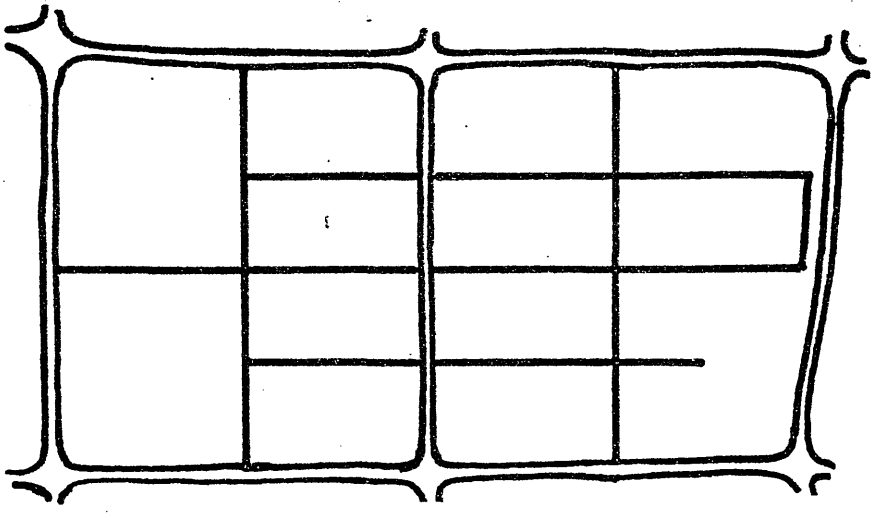


Fig. 53: Diagram of the grid within the grid in Central Milton Keynes

cyclists who have no access to the fast grid and cross it only by underpasses and bridges.

This road system, which works as was originally intended, gives freedom, speed and direct access from any point to another in the city and rejects all solutions which limit freedom in mode of transportation or which lead any part of the city being significantly better served than others. All types of transportation were considered in the Milton Keynes study. The aim at choice of transportation mode was taken as a starting point. Even if full car ownership is reached, there will be still more than thirty per cent of journey to work by public transportation. (23) The transportation system is flexible in that it reacts to demand. According to local surveys, a typical journey to work by public transport takes about twenty five minutes and by car fifteen minutes (Fig. 54). This accentuates the efficiency and convenience of such a road system in fast and free movement.

2.3 Density and Land Use

Milton Keynes has been designated to accommodate 250,000 inhabitants within an area of 22,000 acres. The shape of the city is almost square. Shape, size and density defines land use and transportation. In terms of servicing, Milton Keynes does not place much emphasis on the neighbourhood units. Residential densities were planned at an average of eight houses per acre. A grid square contains the population of a medium size medieval city. Land use in the city offers a wide distribution of

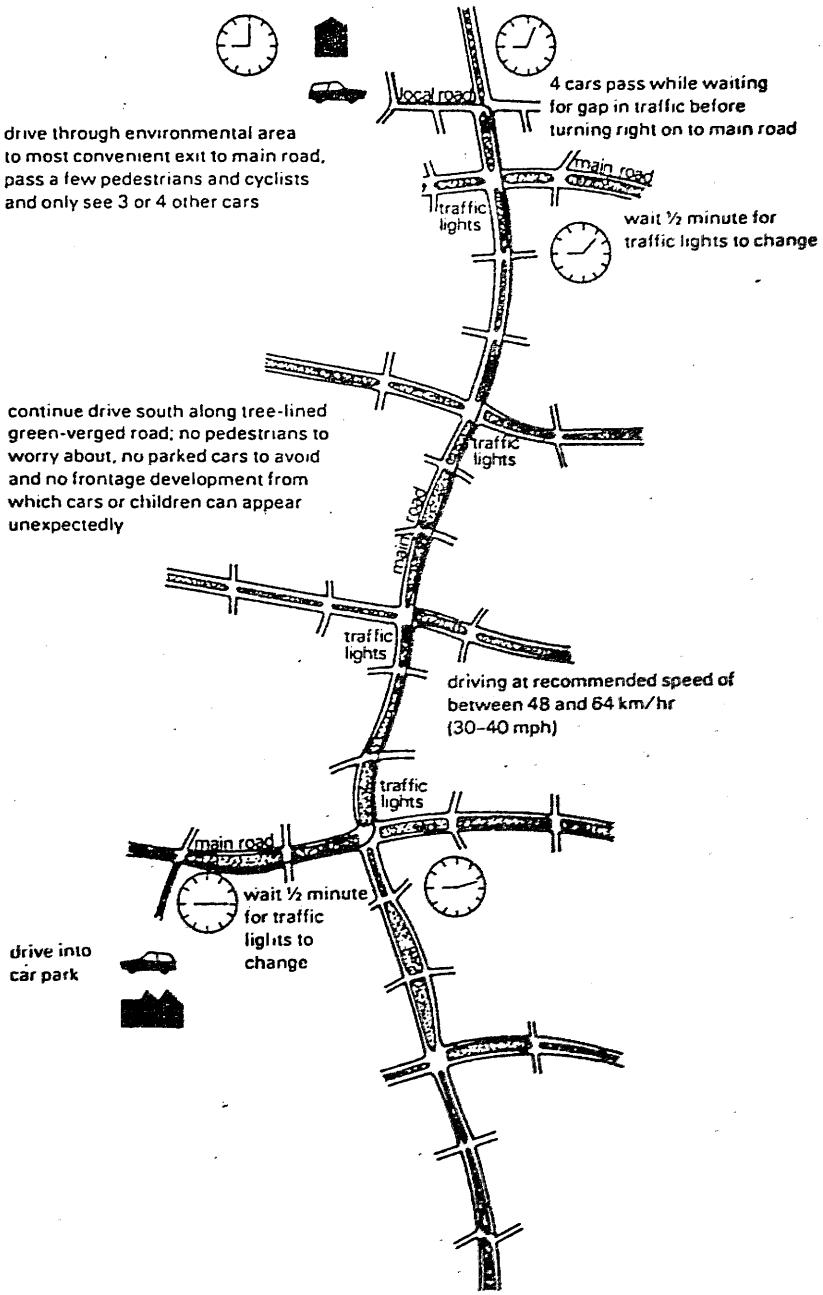


Fig. 54: Typical journey to work by car in Milton Keynes

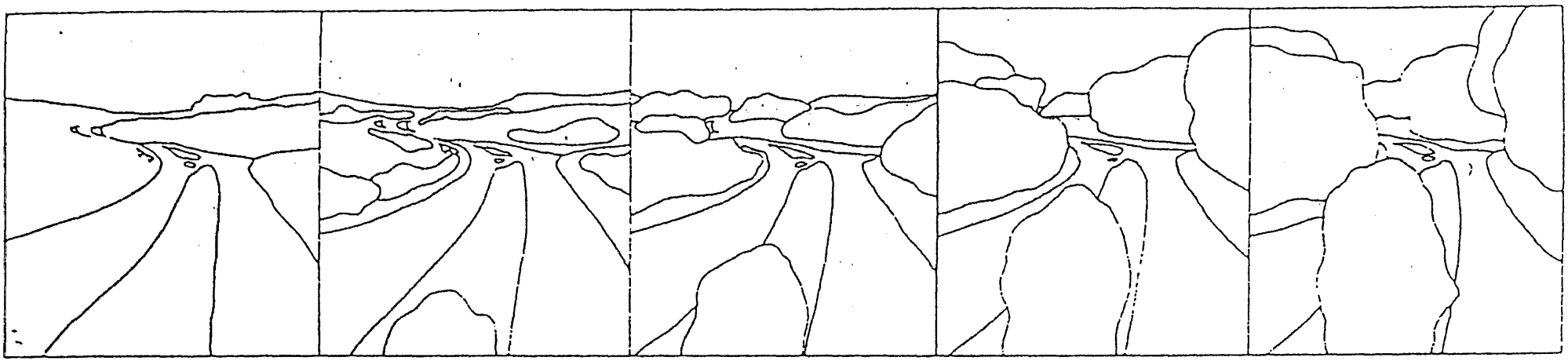
services and employment which assists on providing variety and freedom of choice. Major sites for industry are spread over the entire area and small scale industry is located within residential areas to provide more work opportunity.

2.4 Townscape

The grid in Milton Keynes changes the concept from what a traditional grid is. It is road system grid rather than street system grid. On the whole the city is a great garden city, except for areas such as the city centre. The lack of urbanity due to the low density particularly along the roads, is compensated by landscaping by trees and grass. The quality of landscape will have great importance in determining the character of the new city (Fig. 55, 56). The greenery which borders the main roads is there to combat the problems of noise and pollution caused by motor traffic.

2.5 Conclusion

The Milton Keynes grid is a significant servicing device. It eliminates all netative components which reduce the efficiency and convenience of traditional grids. It is big enough to carry through traffic and allow for fast movement on long distances between main control points. Its hierarchy allowsfor segregation between fast through traffic and slow local traffic. The concept



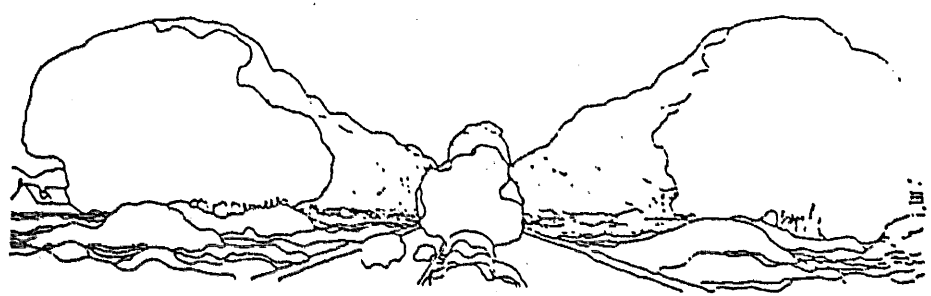


Fig. 55: Importance of landscape in Milton Keynes

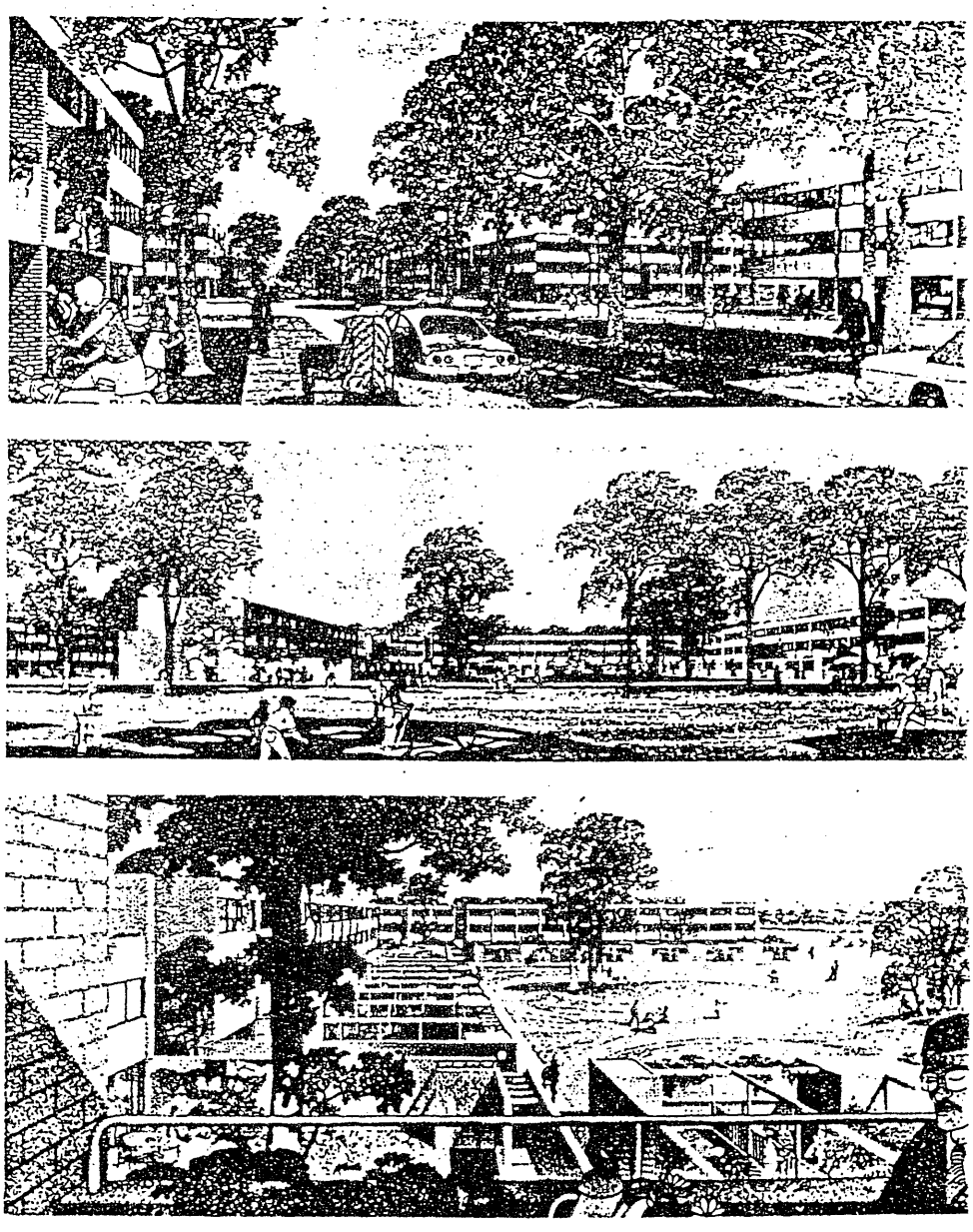


Fig. 56: Streets in Milton Keynes: lack of urbanity

of a grid within a grid allows also for more accessibility in that the fast grid connects the various neighbourhoods to the centre and the slow grid penetrates everywhere. Equality in width for all roads eliminates congestion and traffic problems. No single road received priority which leads to less congestion.

Advantages for using the grid in Milton Keynes:

1. Ability to provide easy movement and access
2. Ability to allow for fast movement on long distance
3. Ability to allow for good communication between any two points in the city.
4. Ability to loow for easy and rapid development.

CHAPTER II : THE RELEVANCE OF THE GRID TODAY

3. Conclusion

After examining the three grids in the three existing cities: Barcelona, Glasgow and Chicago and the new situation in Milton Keynes, we conclude that the relevance of the grid for today, especially from functional point of view, is related and depends on the size of the plot or the grid module. On the one hand the longer is the distance, the more efficient is the mobility of traffic movement. On the other hand, the shorter the plot, the more accessible is the block, the more convenient is the distance for pedestrian movement and the more interesting is the streetscape.

However, hierarchy may be the solutation to satisfy the two types of the grid size.

- Fast grid for greater grid size
- Slow grid for shorter grid size

In this spirit, a proposal will be made for the Glasgow grid, because Glasgow, as we have seen, seems to have the most confused situation in traffic.

Another proposal will be made for Glasgow to increase pedestrian area and to regenerate the public space of the civic centre. The two proposals are to be considered as design strategy.

Comparison of Grids

By superpositon of Milton Keynes supergrid on Glasgow grid (Fig. 57), Barcelona grid (Fig. 58) and Chicago (Fig. 59) we

realize that the evolution of the grid is dependent on its size. This simulation exercise enables us to gain an understanding of the importance of the grid's size which determines the urban character of the city:

- urban qualities
- capacity of accessibility
- traffic movement efficiency

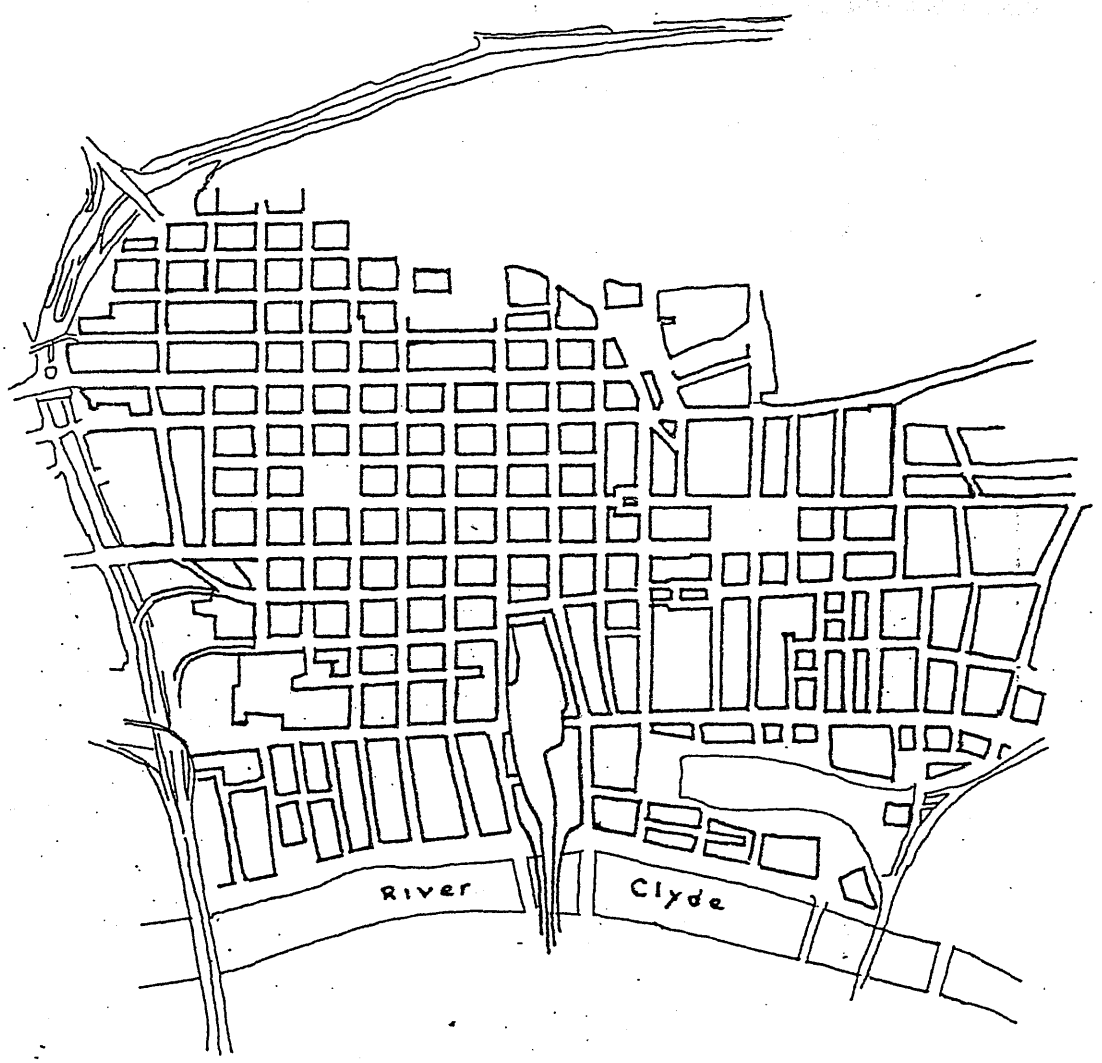


Fig. 57: Comparison between Milton Keynes Super Grid and Glasgow Grid. Scale 1:15000

Fig.58 : Comparison between Milton Keynes Super Grid and Barcelona Grid Scale 1:15000

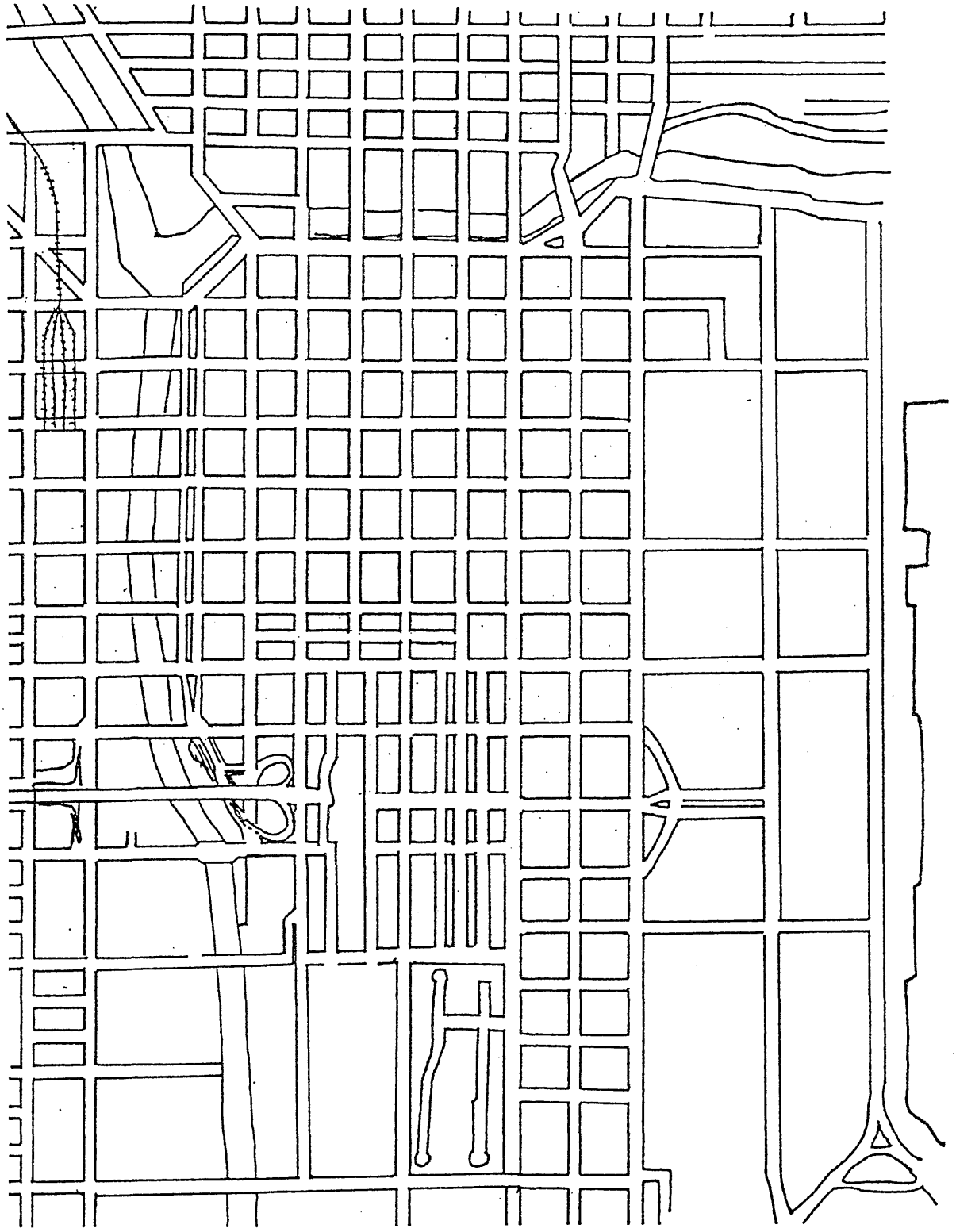


Fig. 59: Comparison between Milton Keynes Super Grid and Chicago Grid Scale 1:15000

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CHAPTER III : THE GRID AS AN AESTHETIC DEVICE.

CHAPTER III : THE GRID AS AN AESTHETIC DEVICE.

1 Introduction

The grid has been challenged for its urban fabric and townscape qualities. Its straight and long streets and their sameness creates monotony rather than dynamism and variety. Its lack of vistas and terminating points creates a weak urban structure and confusion rather than legible and comprehendable townscape. Its rigid strucute and its ignorance to topography creates conflict rather than harmony.

2 General Critics

Camillo Sitte "the father of urban design" criticized Soth Mannhum (1799) (Fig. 1) and renaissance planning:

> "It was carried out already with an unrelenting thoroughness at Mannheim, where plan looks like a chequerboard; there exists not a single exception to the arid rule that all streets intersect perpendicularly and that each one runs straight in both directions until it reaches the countryside beyond the town. The rectangular city block prevailed here to such a degree that even street names were considered superfluous, the city block being designated merely by numbers on one direction and by letters in the other. Thus the last vestiges of ancient tradition were eliminated and nothing remained for the play of imagination or fantasy". (1)

Olmstead and Vaux writing in support for their design for Central Park in New York:

> "The time will come when New York will be built up, when all the grading and the filling will be done and the picturesquely varied rocky formation of the island will have been converted for rows of monotonous straight streets and piles of erect buildings." (2)

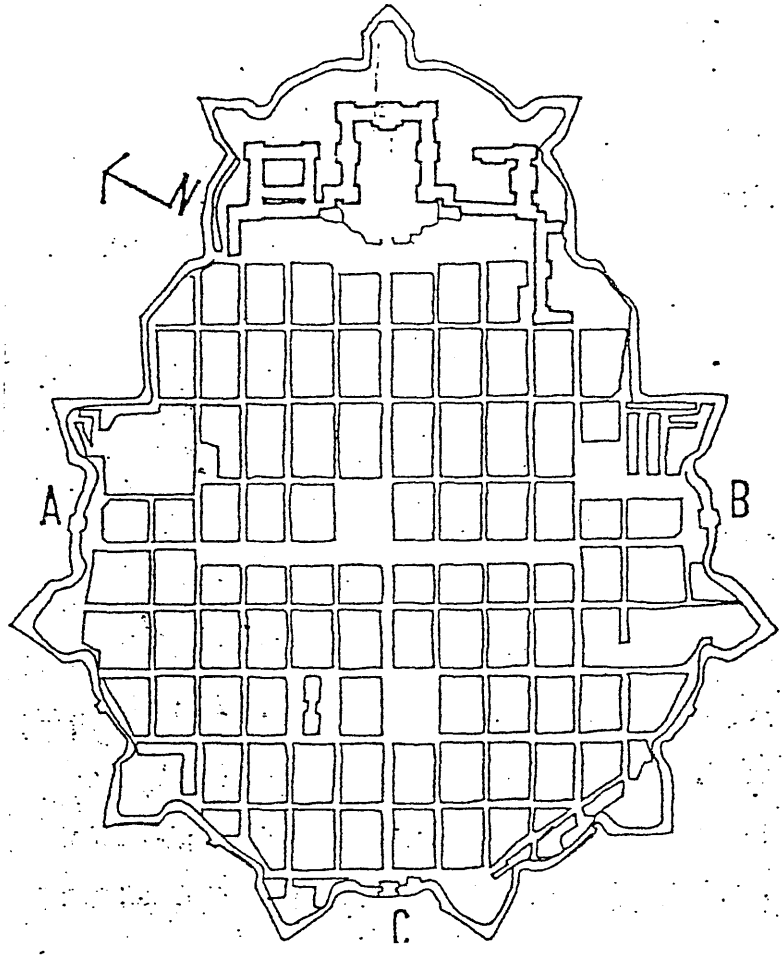


Fig 1: Mannheim: general plan in 1799

John Reps writes:

> "We now view most of these grid-irons with distaste. Their lack of beauty, their functional shortcomings, their overwhelming dullness and monotony cause us to despair." (3)

Kevin Lynch:

> "Grid-iron layouts are often criticized for their wastefulness when all streets are brought to the same standard, for their needless butchery of terrain and natural features, and for their visual monotony and lack of focus." (4)

All these views from urban designers is pointed at the poor urban qualities of the grid. But it can be argued that all these urban disadvantages of the grid could be avoided if the development obeyed to the criteria of modern urban design and planning. Most of the grids were laid out by private entrepeneurs whose individual profits from land development and speculation come first. The grid's ability to tolerate growth and change by easy and rapid development dominated the use of the grid as planning tool, meanwhile its urban qualities were not developed and they were ignored. The developers did not pay too much attention to urban design criteria. Today, there is town planning legislation and theory which has traced a policy to be followed and criteria to be taken into account. There is also public awareness and inspiration towards the beauty of the city. The public is more concerned about public spaces development and they participate more and more in their elaboration.

Glasgow is a good example. Its grid has got many fine urban quality and some disadvantage. The lower part of the grid which includes the civic centre represents an interesting piece of

urban design within a grid. The higher part which includes the New Town, with its rigid and regular grid, compensates its monotony and confusion by high architectural treatment of facades and corners of tenements and terraces, and its ignorance to topography and natural features by eventful and dynamic superstructure.

3. Topography and Morphology

One of the most important features of Glasgow is the topography of the site. There is a close connection between the morphological history and the physical configuration of the site. In addition to the River Clyde, (Glasgow pride) which runs east-west, topography determined the axis and the character of the development.

On the one hand, lower lands towards the east and the south are flat from which resulted an easy expansion by developing industrial estates and working class housing.

On the other hand, to the north and the west, lands are broken up by hills which made it difficult and expensive to develop. These parts were developed as elegant residential neighbourhoods inhabited by middle classes and the grid was not adopted, eg. Woodlands Hill. The result of integration to the site is a mixture of interesting varied form and generous provision of landscaping, especially along the River Clyde (Fig. 2)

4 Public Open Spaces

As we have seen, the character of Glasgow's townscape is

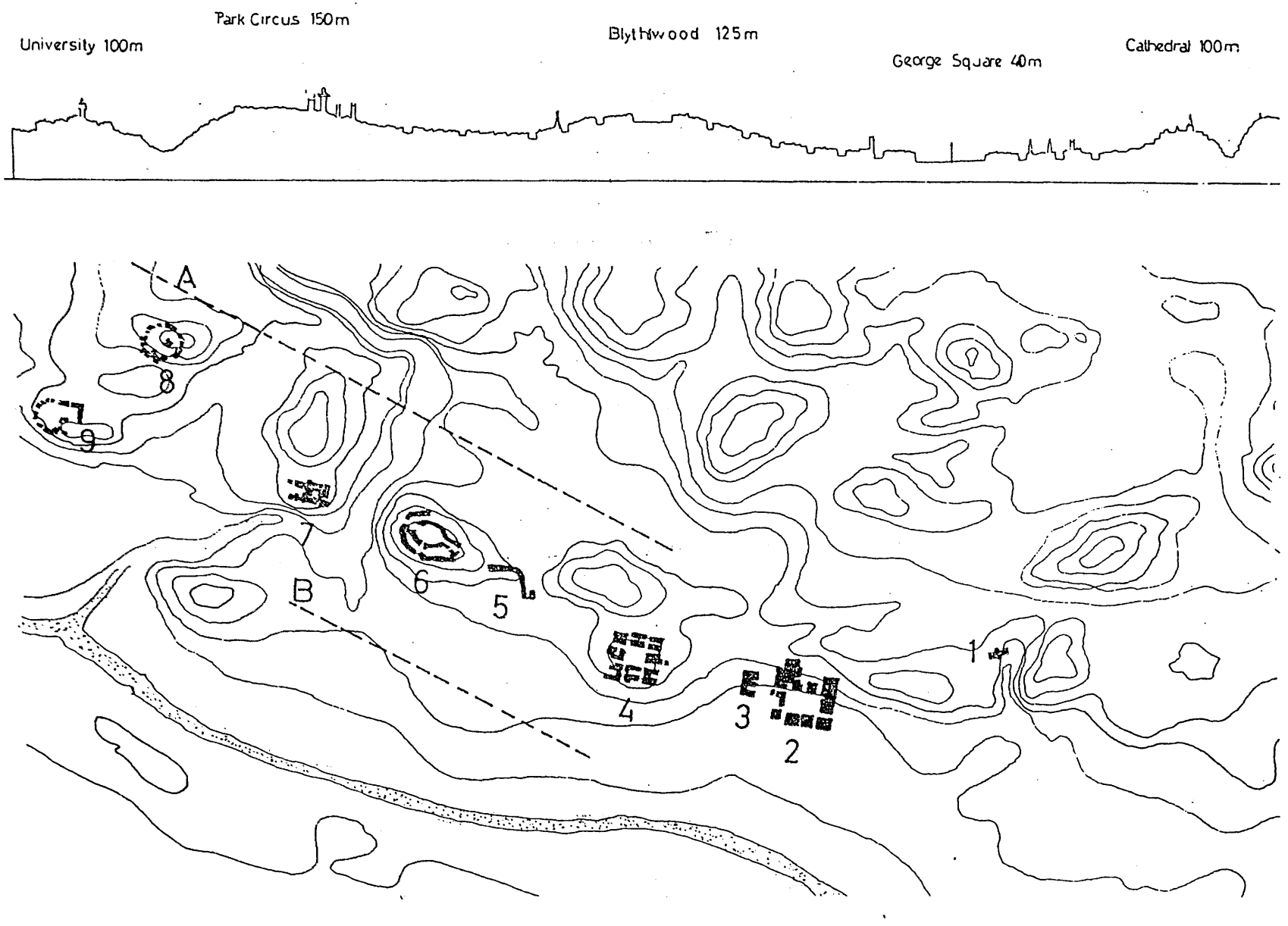


Fig. 2: Topography and morphology of Glasgow.

determined by the topography of the site. The strict urban geometry is divided into two parts articulated by Buchanan Street: (Fig. 3, 4)

4.1 Merchant City

The Merchant City is located between High Street and Buchanan Street on flat area. It represents the first phase of Glasgow's westward expansion. The layout is a rectangular grid straggled. The streets are short and narrow, buildings are four storeys high; giving sharp perspectives. Most of the streets are determinated by major buildings to provide terminal vistas and to create focal points much as Stirling Library in the Royal Exchange Square and St. George's Tron Church in St. George Place. (Fig. 5, 6)

George Square was the beginning of new views of urban design. Originally the square was too large for the buildings surrounding it which were three storeys high. But today, with large public buildings on three sides and the tower of College Building to the north and the City Chambers to the east (Fig. 7, 8) the square has a formal and monumental character which makes it the civic centre of Glasgow.

But the square seems to be isolated from its surroundings and the central space does not belong to any building in the surroundings. The car has killed its life and transformed it into an island of traffic. It seems also to be detached from its immediate surrounding and to have a weak link with the two public spaces nearby: St. George Place and the Royal Exchange Square, (Fig. 9, 10,)

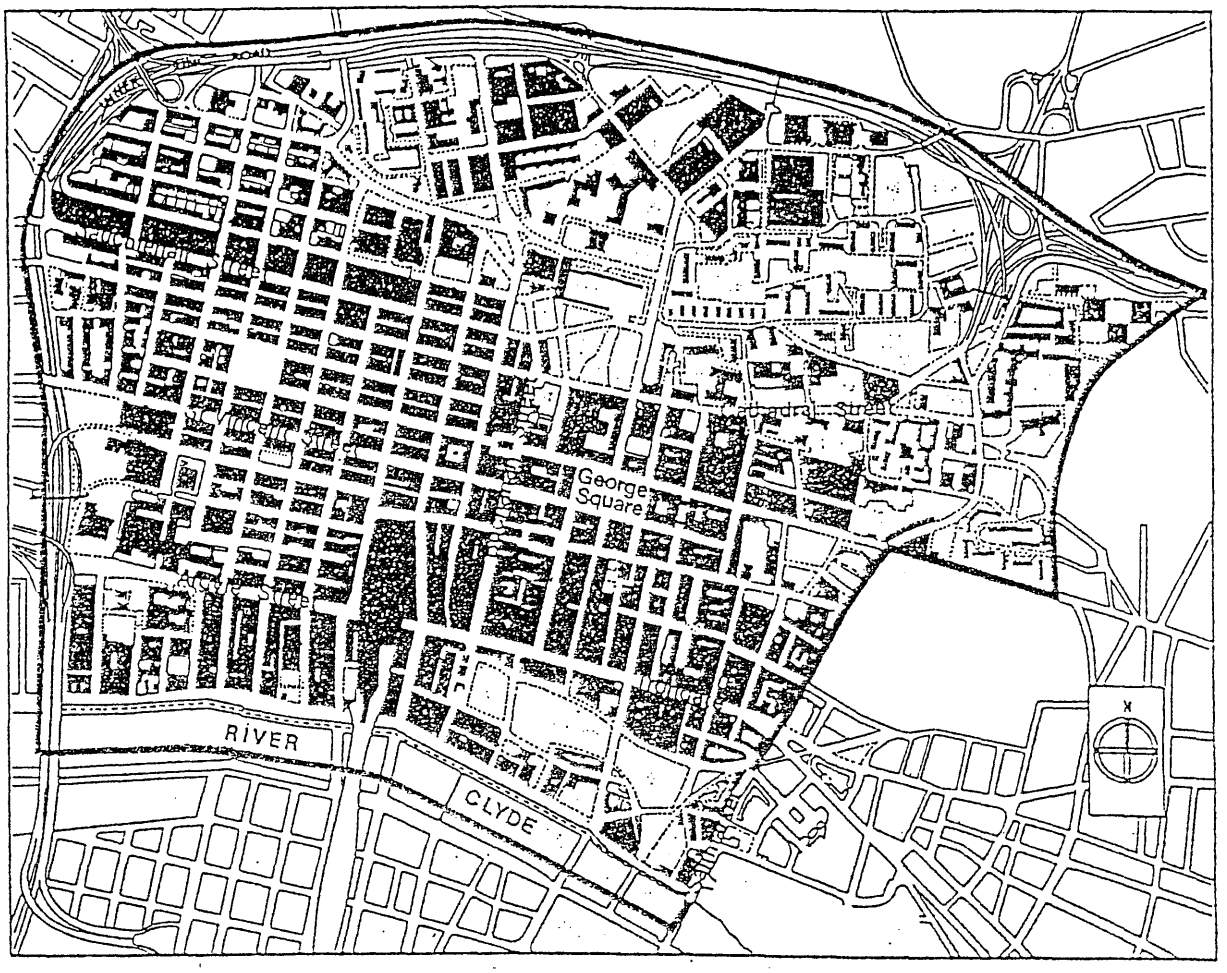


Fig. 3: Urban form map of Glasgow 1985

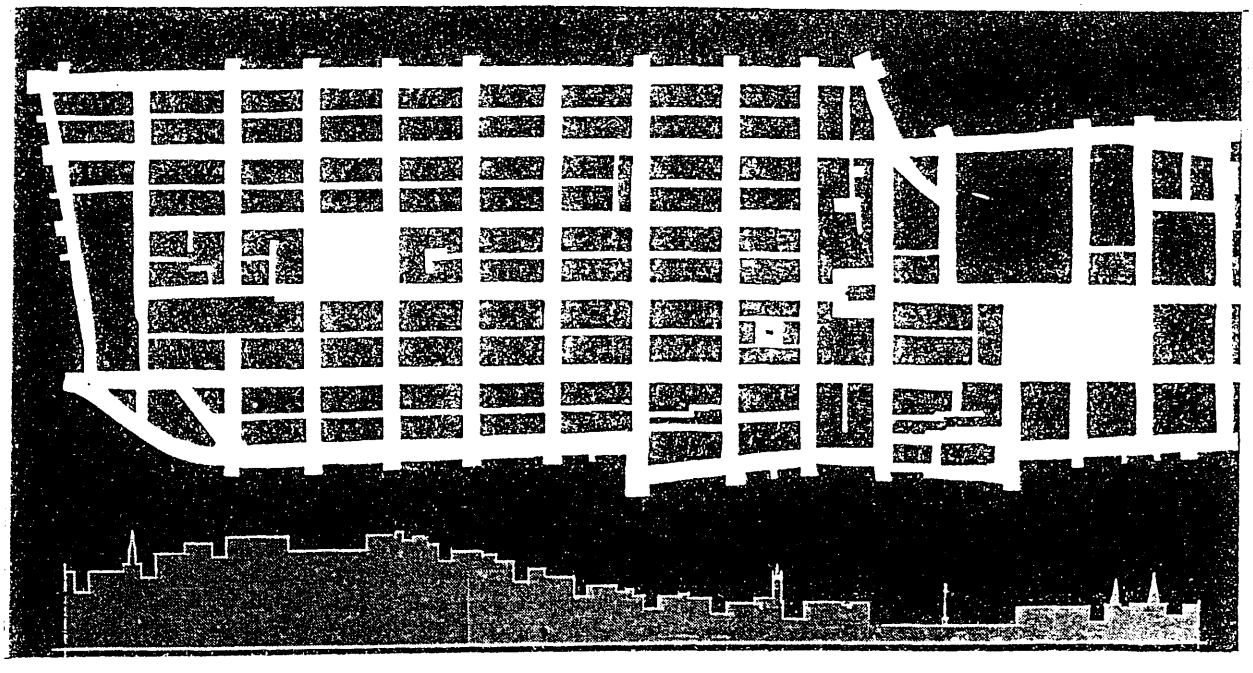


Fig. 4: Plan and cross section of Glasgow grid

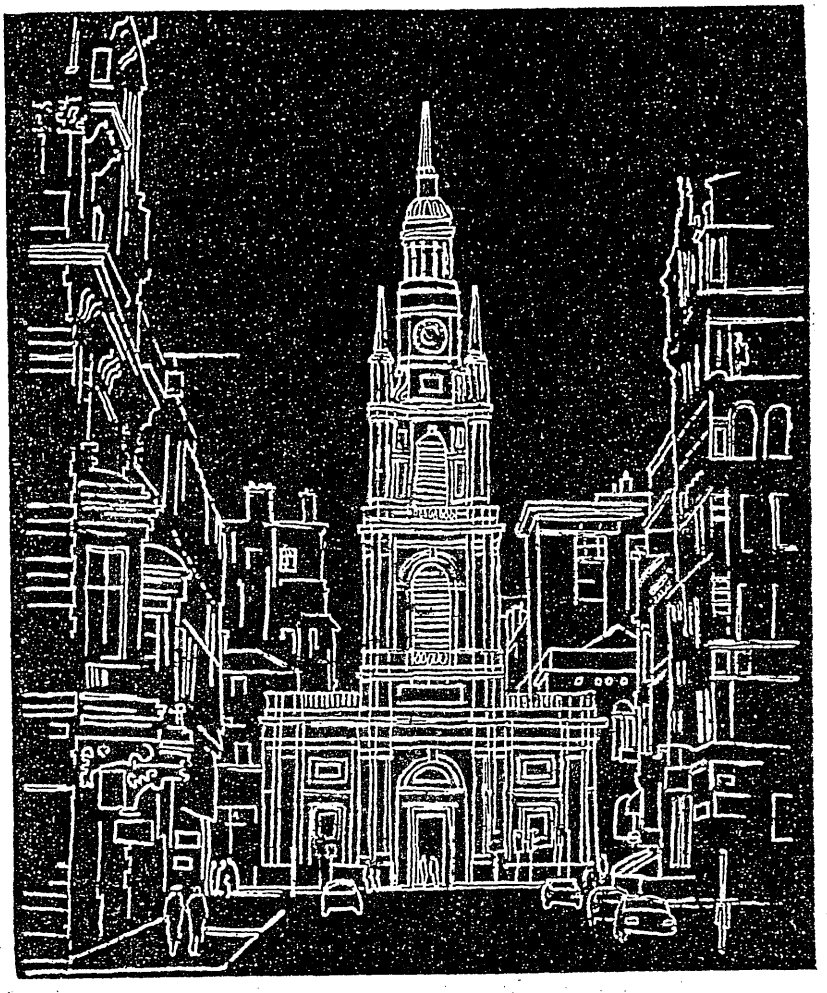


Fig. 5:

St. George Church,

Glasgow

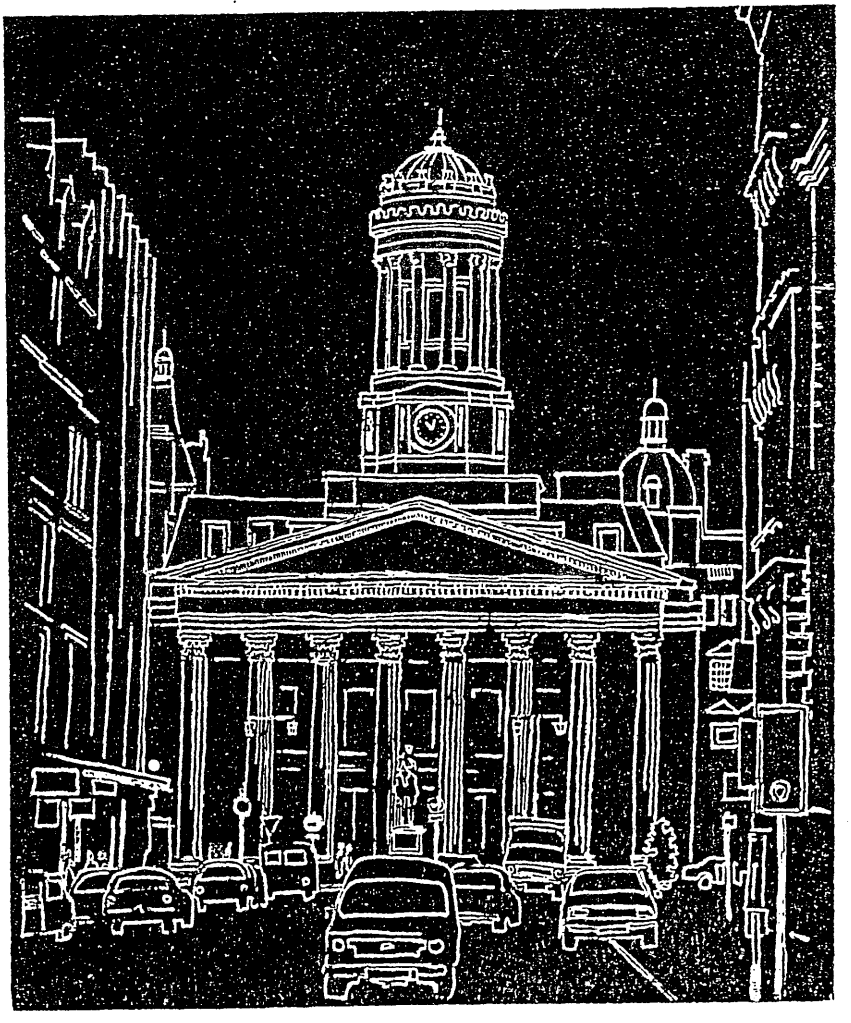


Fig. 6:

Royal Exchange

Square, Glasgow

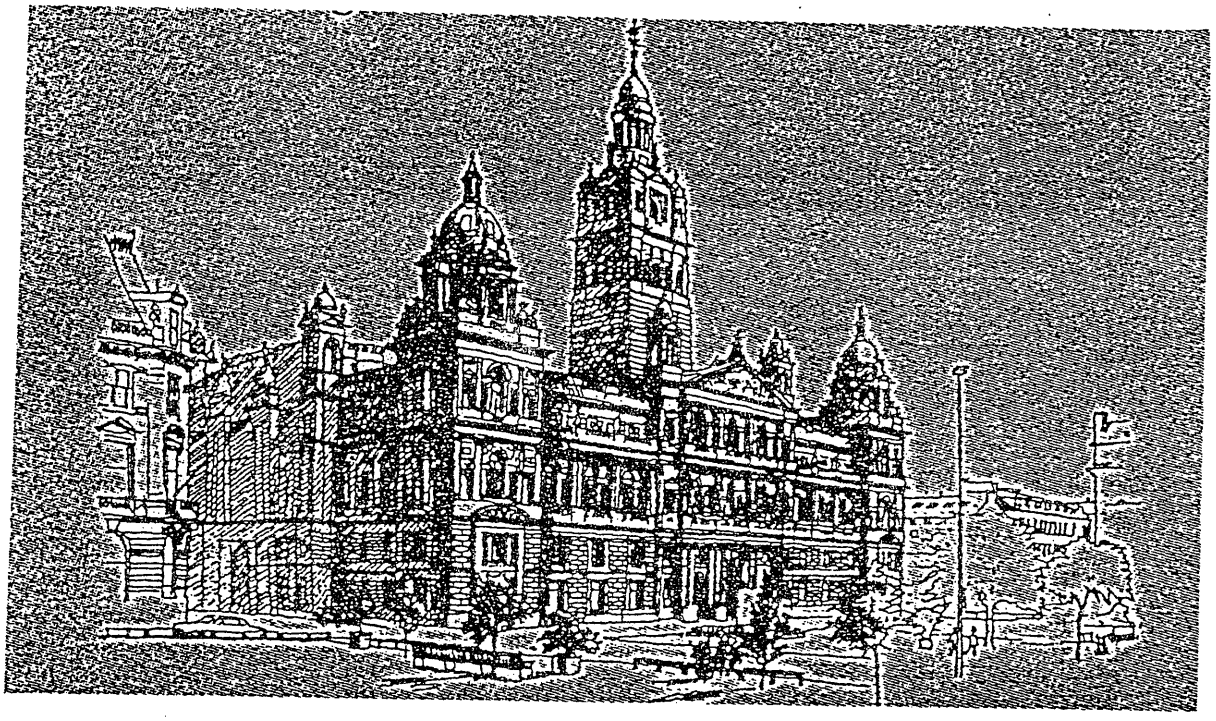


Fig. 7: City Chambers, Glasgow

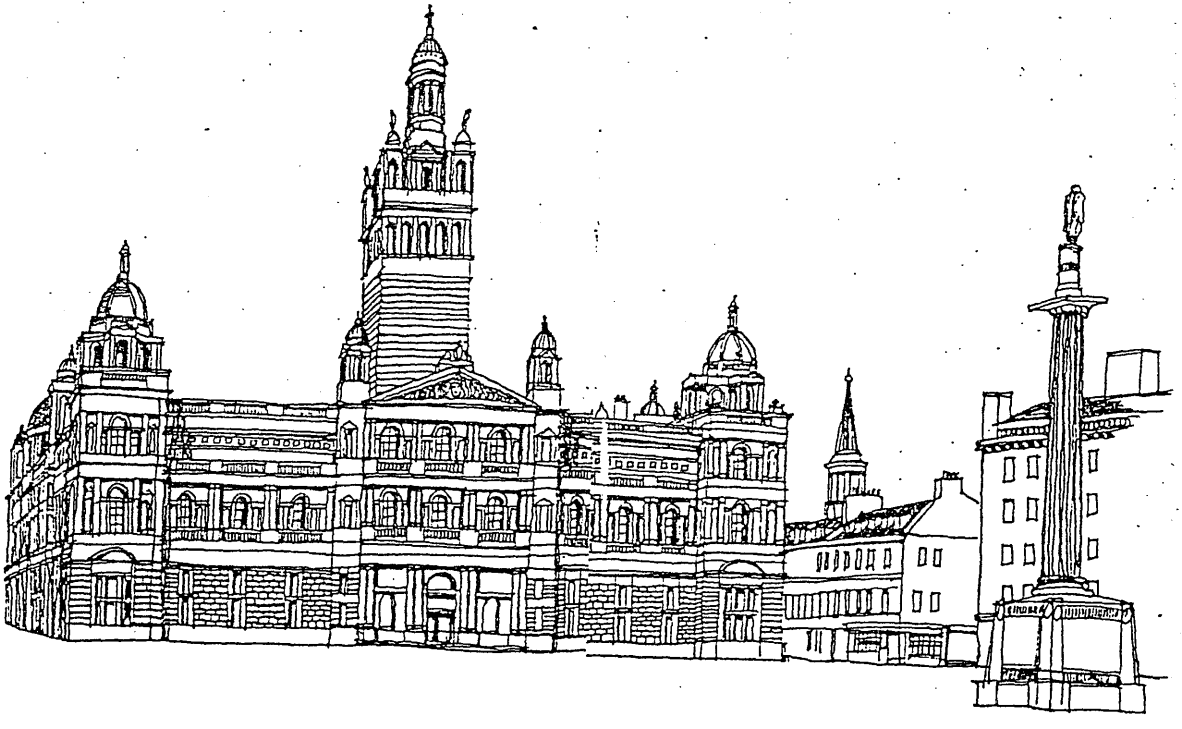


Fig. 8: City Chambers, Glasgow

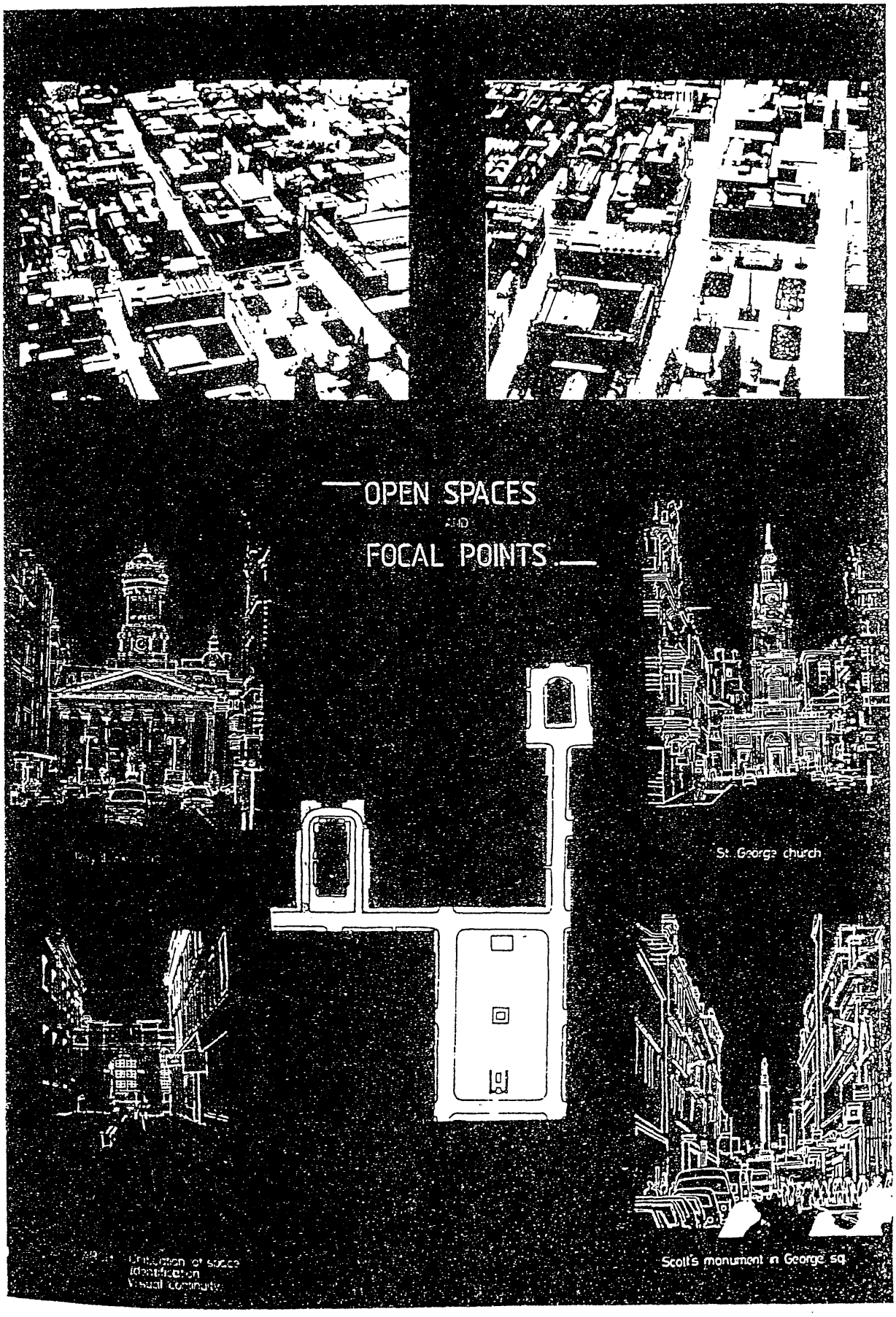


Fig. 9: Public open spaces in the Glasgow grid

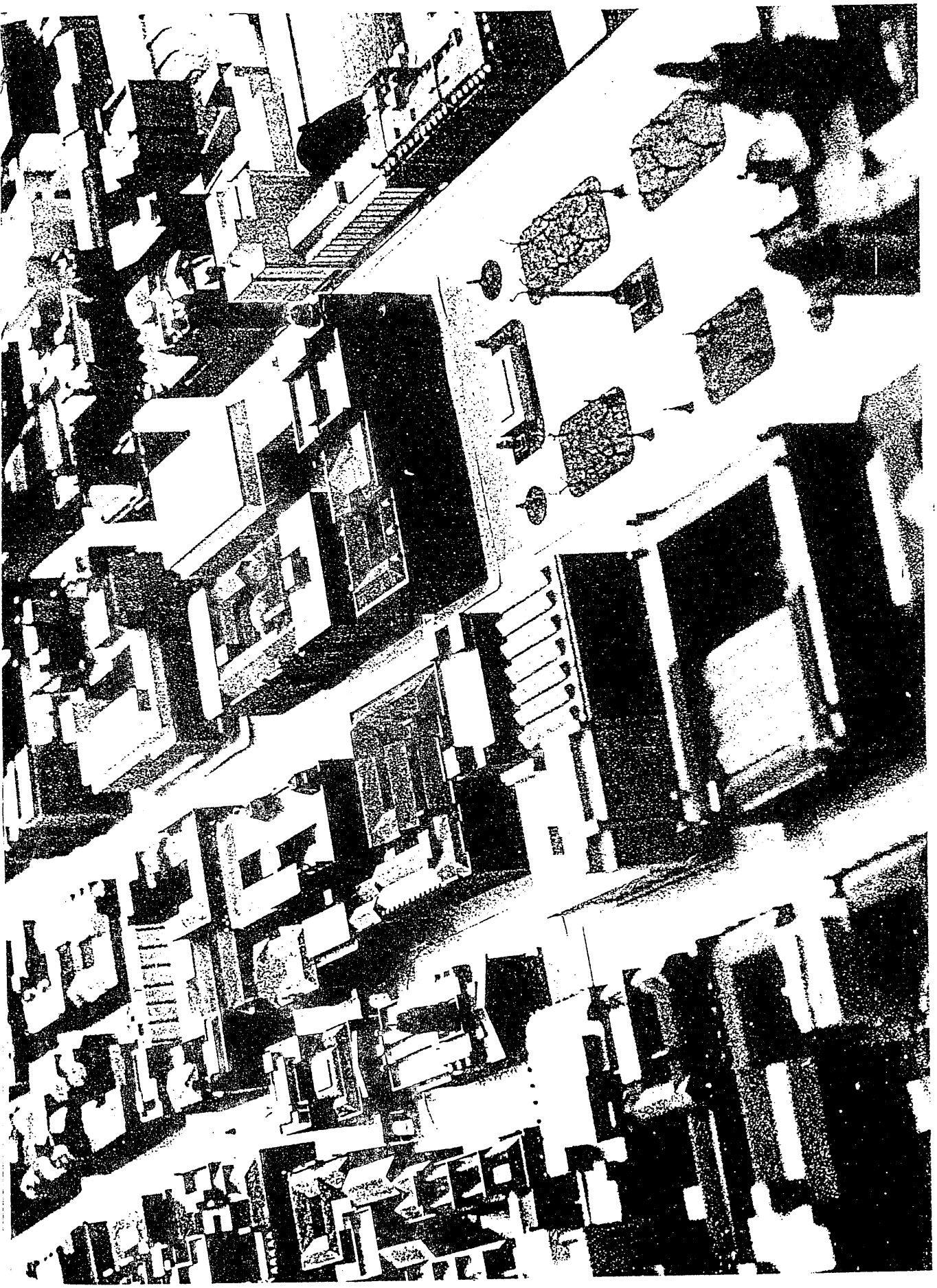


Fig. 10: Aerial view of public open spaces in Glasgow grid

4.2 New Town

The new town extends from Buchanan Street to Blythswood Square. It is the westward expansion of the Georgian city and entirely new and different from the previous development even if some streets from George Square are a continuation across Buchanan Street. The layout is rigid and regular grid-iron applied to sloping site. The hill gives three dimensional shape to the grid-iron layout. The streets are wide and building (terrace houses) are three storeys high. Originally, the new town was entirely residential without public buildings. Therefore, there were not vertical accentuation but the extremely steep slope of the hill gives the buildings more verticality than they would have if they were on flat site. Topography gives an interesting street scape. The broken superstructure resulted from integration . The site gives movement and dynamism. Thus the three dimensional plan is more interesting than the two dimensional plan of a rigid grid-iron. The topography also limited the length of the plot from which resulted small blocks creating plot width which gives rhythm and variety. On the top of the hill, Blythswood Square was planned as a residential square. (Fig. 11) Terraced houses of three storeys surround it and a garden occupies the middle. Today the square has become a car parking and lifeless area. The buildings were transformed into offices and administrative activities dominate.

Bath Street seems to be the most interesting street in the new town. It is flatter and wider with three storeys. It

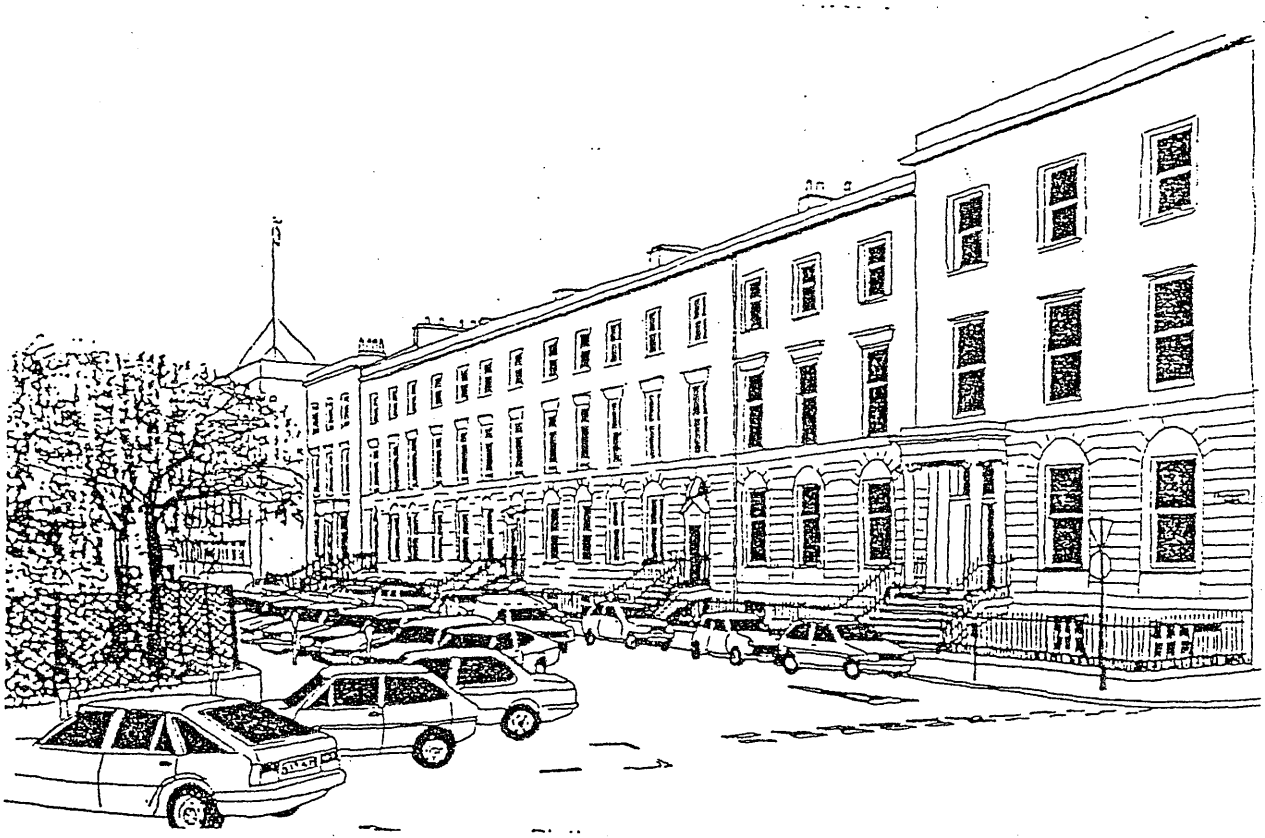


Fig. 11: Blythswood Square, Glasgow.

has a variety of architectural styles. To its west, two churches at the corners introduce a new punctuation and a great range of four storeys tenements introduced a change of scale. These two new components make Bath Street's townscape excellent (Fig. 12, 13)

The new layout transformed Sauchiehall Street from irregular thoroughfare to a wide and straight avenue built up with elegant and rich individual houses, and St. Vincent Street built up with elegant short houses.

5 The Tenement as a Building Element of Glasgow Grid

Glasgow's urban form is defined by and was developed in the 18th century and the tenement block which was developed in the 19th century. Glasgow is the city of the tenement which is the most important spatial configuration of the grid-iron layout and one of the most significant features of the character of its streets.

> "The tenement makes the town and the town makes the tenement. A continuous linear building form, it is capable of infinite response to the needs of sides of slope, of style and the need for variety of accommodation". (5)

As a simple way to contour the edges of the grid plots, the tenement defines clearly the limits between external space (public) and internal space (private) and encloses the social space required by society. Its basic inspiration or model was late Georgian of the Edinburgh and Glasgow terraces. The scale is three to four storeys. The facade reflects the

Fig. 12: Bath Street, Glasgow

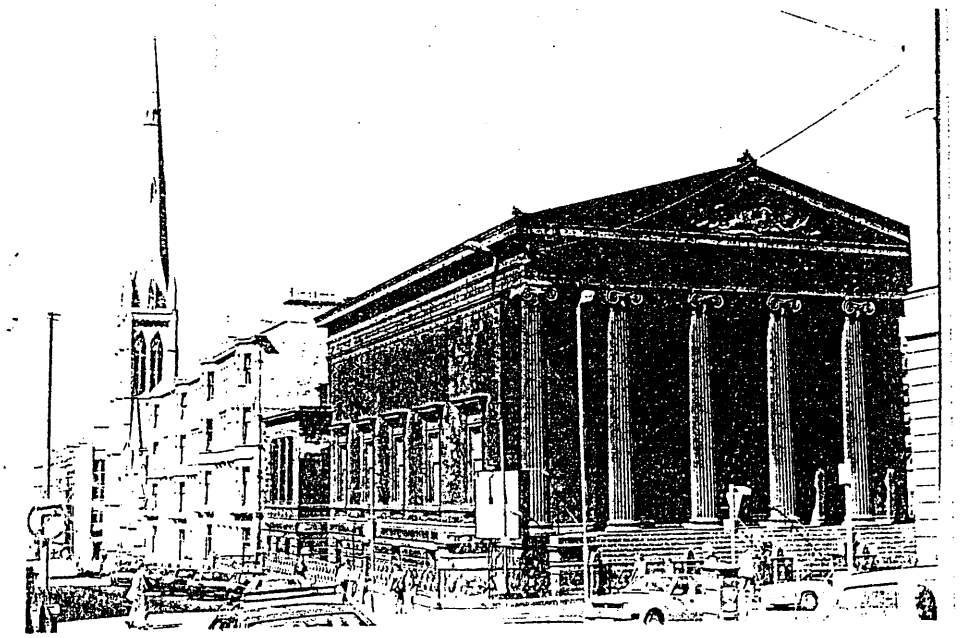


Fig. 13: Bath Street, Glasgow

function, the tallest windows are in the first floor where all the rooms are, the next size on the ground floor and the smallest on the top. Architecturally, the front facade is more developed than the back facade where service rooms are. The tenement encloses private back space (courtyard) used as green space, service space and playground for children.

The most important problems that faced the tenement in its design were the monotony and the corner treatment. Since streets in the grid are often long and straight, with a range of tenement unbroken for a long distance, the problem of monotony should be very important. To avoid this horizontal and vertical monotony and this boredom, the design of the facade of the tenement was based on:

a. Endless repetition of spaced windows along a flat facade.
b. Adding a heavy cornice or series of pediments for emphasis to the first floor, giving a visual unity to the window panel which is taller than the window itself.
c. Introduction of bow and bay windows.
d. Replacing the classical principle of an even spacing by organizing the windows instead in pairs or in threes.
e. Introduction of canted bay windows providing strong vertical emphasis and horizontal rhythm.
f. The appearance of towers, turrets and chimneys at the corners of the tenement block offering punctuation of horizontal rhythm.

g. Building up the blocks in a number of units designed as a whole unit. This accentuates a horizontal rhythm by breaking down the urban facade to successive plot widths. (Fig. 14, 15)

6 Corners

The corner is the vital point which defines the urban unity in the grid layout and provides expression between the block and the street (Fig. 16). The aggregation of four corners at the intersection of street creates a place within the hierarchital grid structure. Apart from its problem as block planning (light, access and structure) the corner by its position offers an ability for enhancing the streetscape offering a great variety of form.

Within the grid system, corner building can often act as reference point (Fig. 17). Thus important building types and activites are located in corners with high architectural treatment.

Towers, turrets and chimneys are located on corners to strengthen the urban legibility to break the skyline and to punctuate the streetscape giving movement, dynamism and variety to the whole townscape. The next pictures give an idea about Glasgow corners and their importance in legibility and their high architectural treatment, making them elements with special character. (Fig. 18, 19)

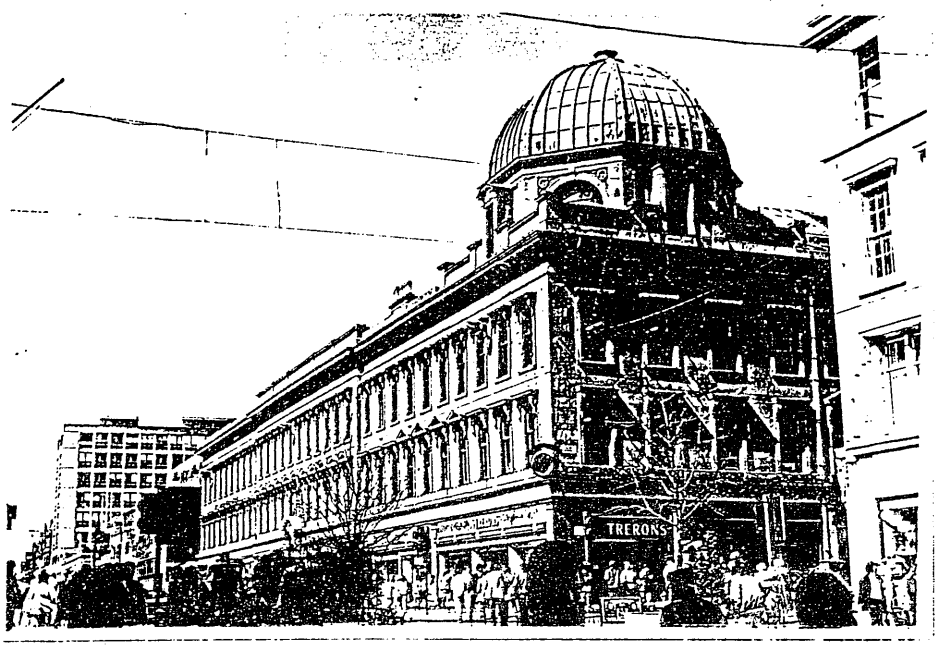


Fig. 14: Tenement block - Sauchiehall Street, Glasgow

Fig. 15: Tenement block - Sauchiehall Street, Glasgow.

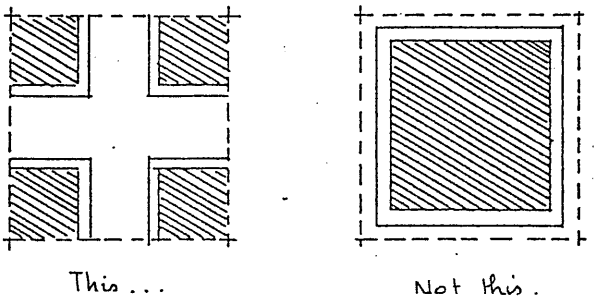


Fig. 16: The urban unity in the grid

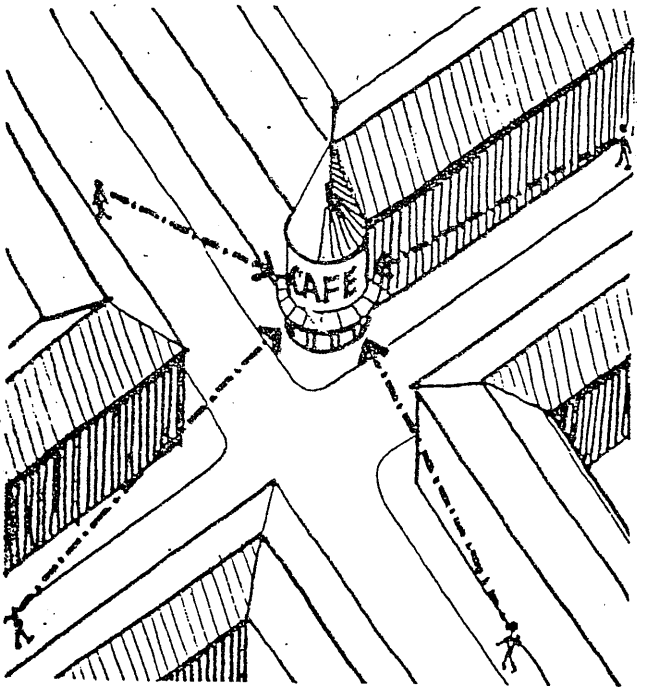
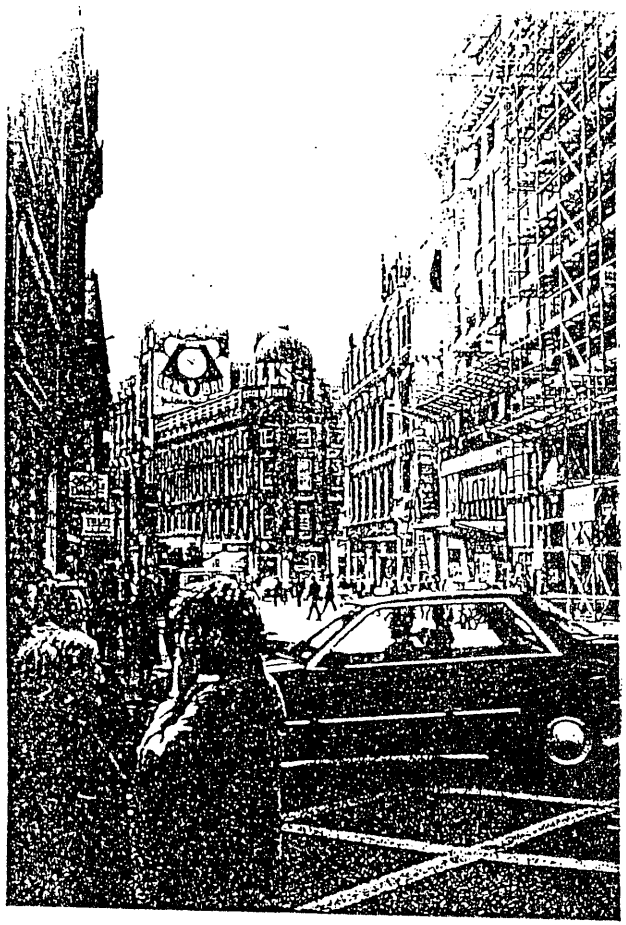
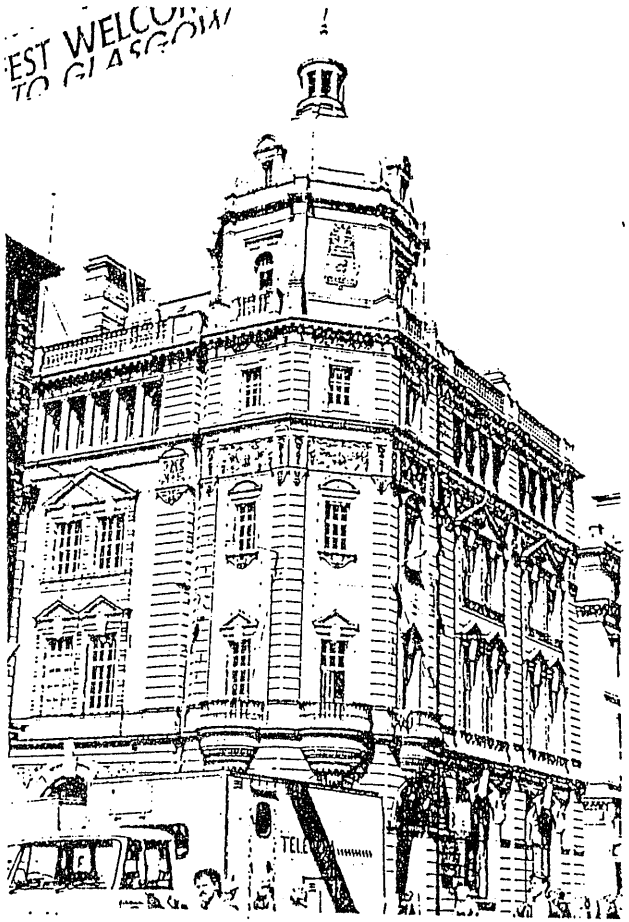


Fig. 17: Corner as point of reference





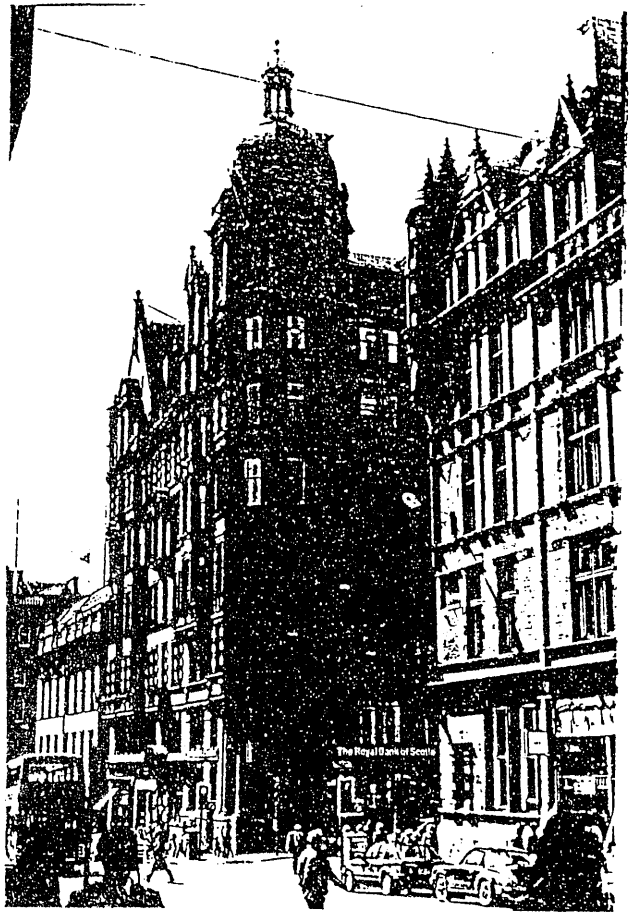
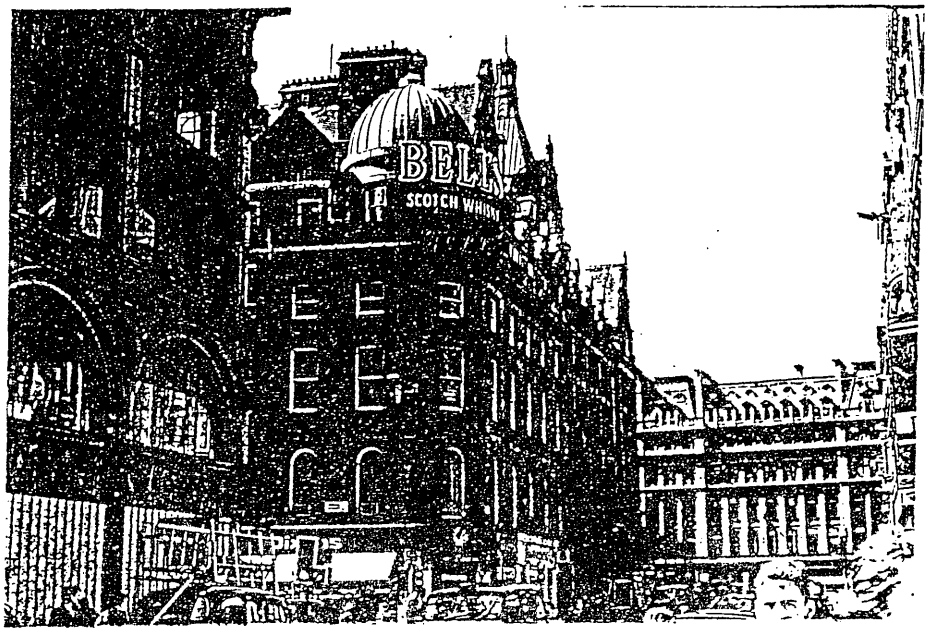


Fig. 18: Glasgow Corners



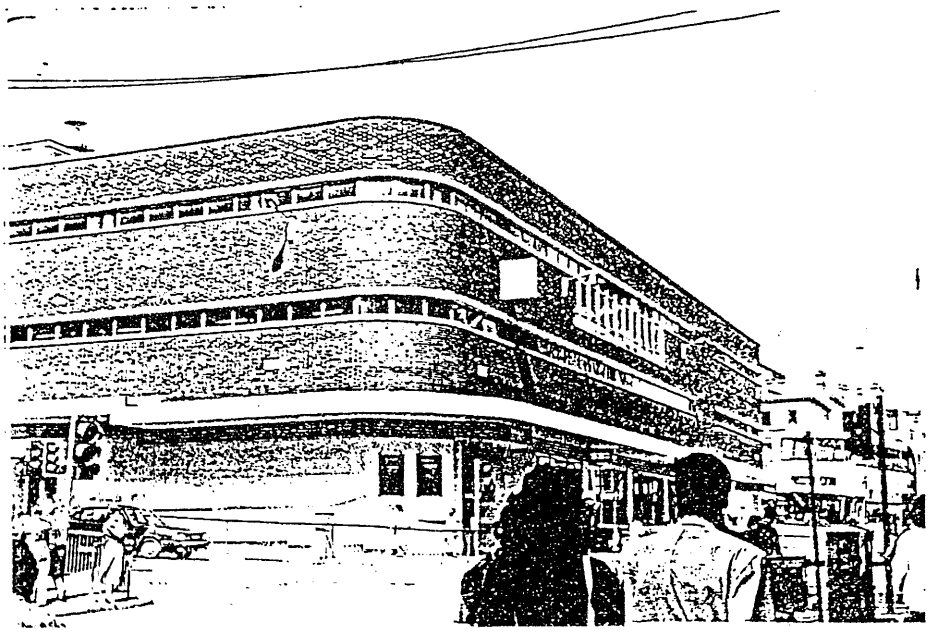


Fig. 19:

Glasgow Corners

7. Conclusion

Regeneration of Glasgow's Townscape

Buchanan Street has a very important role in the urban fabric of Glasgow. It represents the vital point which articulates the two parts of Glasgow's grid: the Merchant City and Blythswood New Town. It is also a part from the Z Glasgow Shopping area. It meets Sauchiehall Street at the top and Argyle Street at the bottom. The meeting points are residial spaces and represent gaps in the grid. They create weak points in the urban structure and negative elements in the townscape. To eliminate these gaps and to enhance the townscape, they represent urban design opportunities which can be taken to create public spaces contributing to the whole townscape.

One of the proposals which has taken this opportunity is Cullen's (6) (Fig.20). Cullen has produced an Edinburgh New Town in Glasgow; two squares linked by an axis. He has transformed Buchanan Street into a strong axis by means of vistas are focal points located around the two squares. This concept of finite piece of the grid (curtailed at either ends by two spaces) does not affect the grid in principle since the gaps exist already but it does affect the areas behind the two squares. They create barriers which isolate these areas. Behind Enoch's yard, the river bank which has been developed as a leisure area (walk way - Scottish Exhibition Centre and Glasgow Garden Festival)

Behind Caledonia Square, Cowcaddens which has been transformed from industrial estates into residential areas. Industry is giving way to housing. However, links between the two squares and the areas behind are necessary to avoid isolation and to create continuity between those areas and the city centre. This can be done by a scheme of progression of spaces and strong axis between the two squares and these areas.

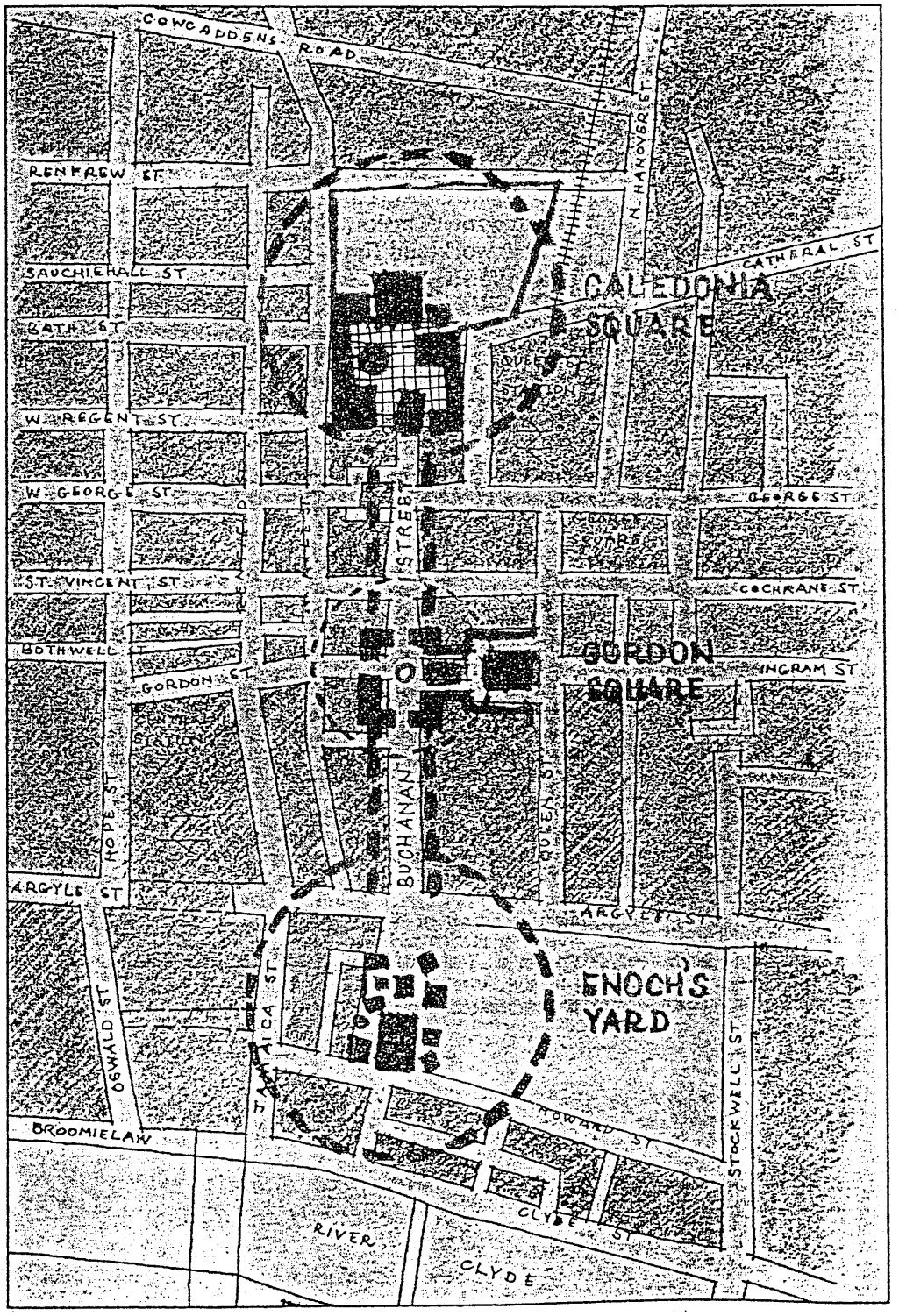


Fig. 20 : Cullen's Proposal for Glasgow

PROPOSALS : MODIFICATION OF THE GLASGOW GRID

PROPOSALS

The proposals are not definite solutions to the problems arisen from the analysis and which are related to Glasgow's grid. They are alternatives which can be ideas to how these problems can be tackled. They are presented as design strategic views which illustrate the basic principles. These proposals may not have taken into account the real data and full information about the study areas especially those concerning traffic engineering in Glasgow. The proposals are based on data from information available and my own experience.

PROPOSAL : No. 1

Hierarchial Grid

As we have seen from the comparative analysis between Barcelona, Glasgow, Chicago and Milton Keynes, Glasgow's grid has not got any hierarchy in the whole layout from which has resulted a confused situation in terms of traffic movement. All streets are brought at the same standard and the plots are small, creating a mixture of through fast traffic and local slow traffic in the city centre. However, the proposal aims to suggest a hierarchy in Glasgow Grid based on the concept of a grid within a grid:

a. Fast Grid

Since the inner-road exists and acts as byepass around the central area of Glasgow and carries through fast traffic at strategic level, it can also serve to improve motor traffic in the city centre. From information available, some street, in Glasgow's grid, are busier and more frequented by traffic. They provide for a certain hierarchy but not as fully as it should. They are organized in one traffic direction and act in pairs. (Fig. 1) These streets are:

Renfield Street and Hope Street

Bath Street and Sauchiehall Street

Argyle Street and Clyde Street

The inner-road, being a motorway, tends to have concentrated traffic which converges to it whereas the grid tends to spread and ventilate traffic which diverges from it. This conflict leads to maintain the balance between traffic ventilated from

the grid to the inner-road and the capacity of the necessary limited function to it.

West Regent Street has replaced Sauchiehall Street of which a great part if pedestrianized. It joins Bath Street and West Nile Street to keep fast traffic out of the civic centre.

b. Slow Grid

The remaining streets in the grid will be organized in one way traffic direction and kept for local traffic which is related to service and public transport. The pavements are doubled, therefore the traffic area for pedestrians increased. (Fig. 2)

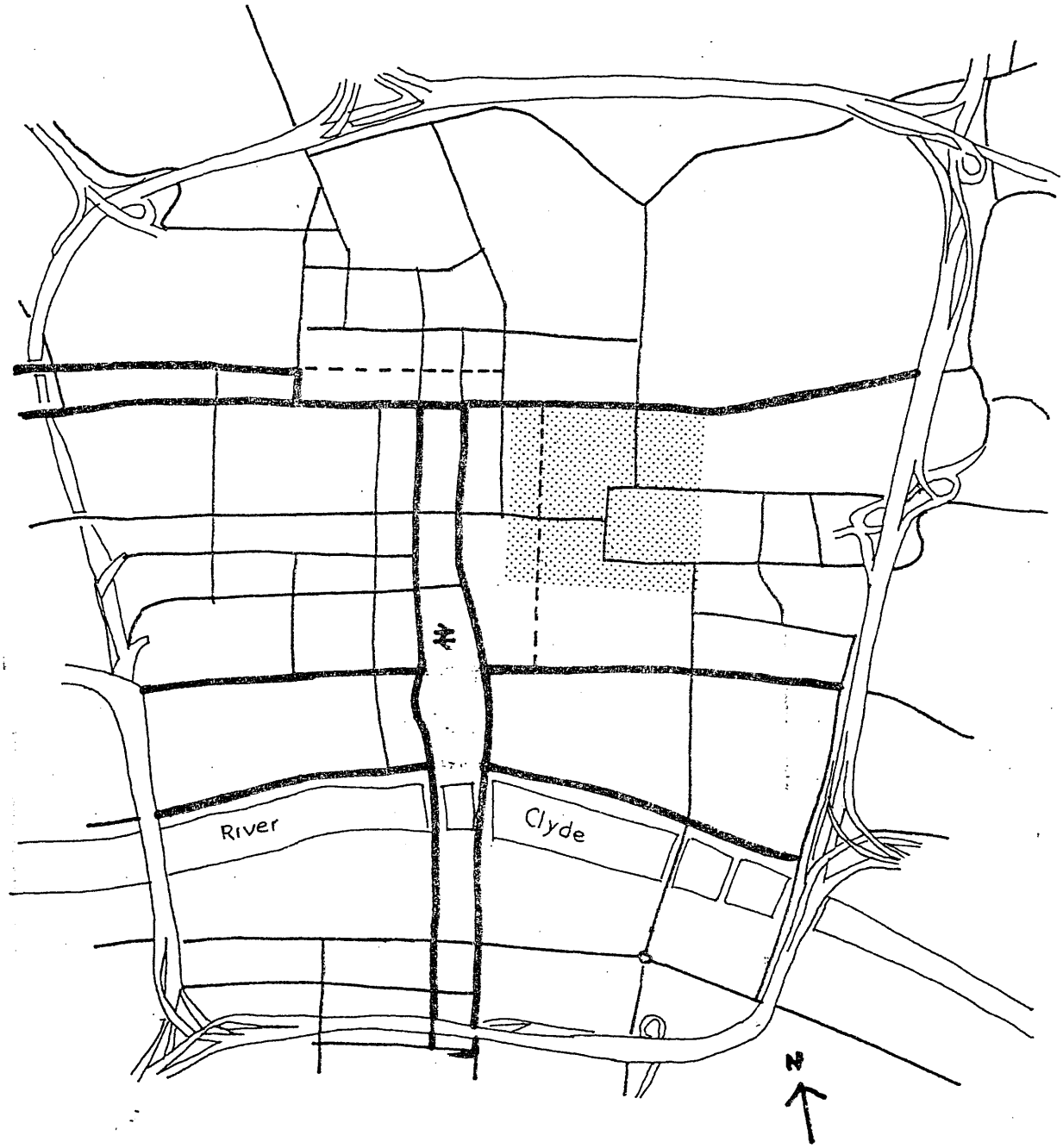


Fig. 1 : Glasgow: Existing transportation system

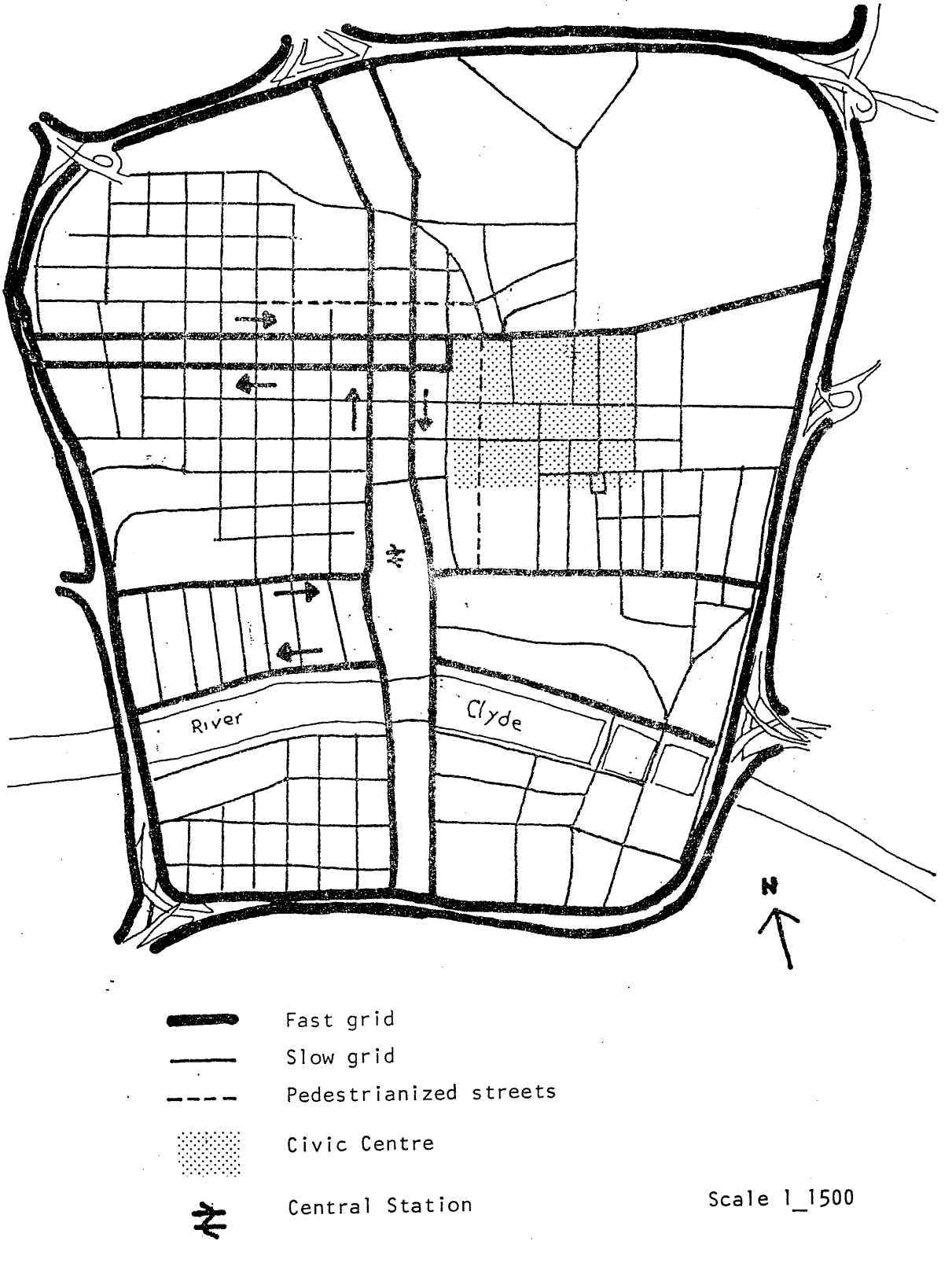


Fig. 2: Glasgow: Proposal of transportation hierarchy

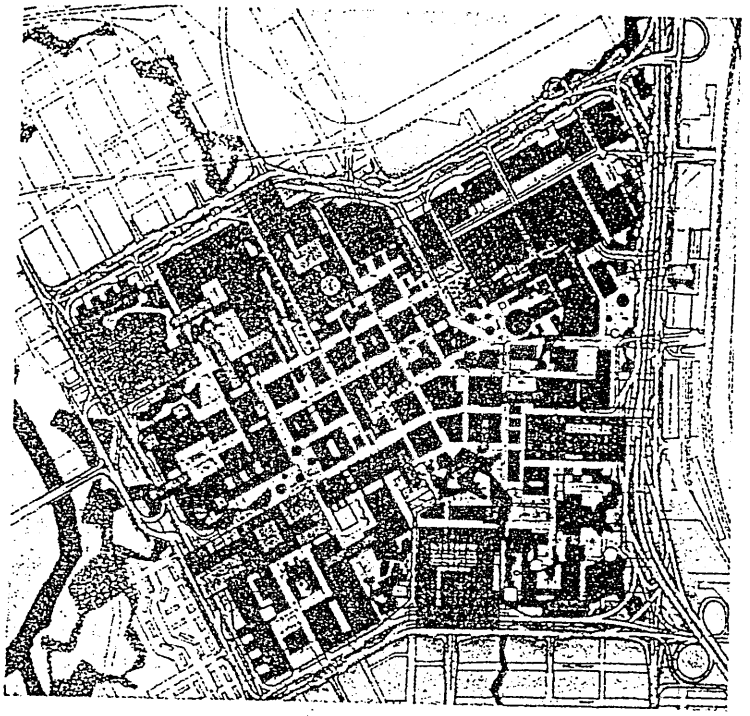
PROPOSAL : No. 2

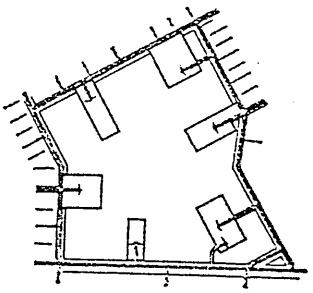
Regeneration of Glasgow Civic Centre

The proposal aims to give an identity to George Square and make the central space belong to its surroundings. At the present, the central space is isolated and bounded by motor traffic which dominate and destroys the human dimensions. I must recognize that eliminating entirely traffic from the area is a partial solution which could worsen the situation in other parts nearby. It would be interesting, as it was done in Fort Worth's city centre in Texas, where the motor traffic is kept out of the centre and stopped at the periphery where parking and bus stops are located. The city centre is pedestrianized entirely and people can walk from the parking and bus stops to any point in the centre within three minutes (Fig. 3).

However, traffic will be kept but reorganized in such a way the central space of George Square is given identity and identification. The streets east and west of the central space are eliminated and replaced by one street which runs into the middle. Thus the central space is divided into two spaces. One belongs to the City Chambers and the other to the railway station(Queen Street Station) and the public building at the east. This public building, which is now the headquarters of the Bank of Scotland, is to be changed to other public building which needs external space and attracts people such as a museum.

A portion of West George Street and Queen Street are pedestrianized in order to strengthen the link between George Square and the two other public spaces (Royal Exchange Square





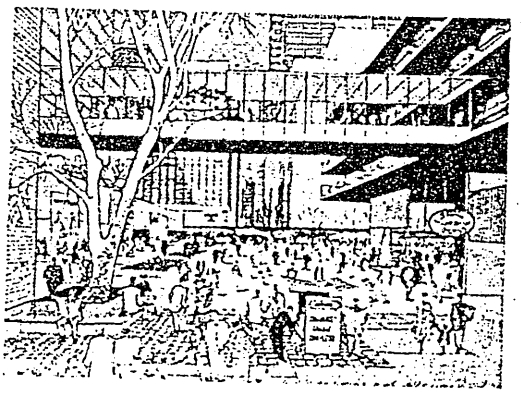


Fig. 3: Fort Worth's City Centre, Texas.

and West George Place) and to enhance the character of the area. The two spaces of George Square are linked by the same floorscape to give priority to the pedestrians and to strengthen the link between them. (Fig. 4, 5)

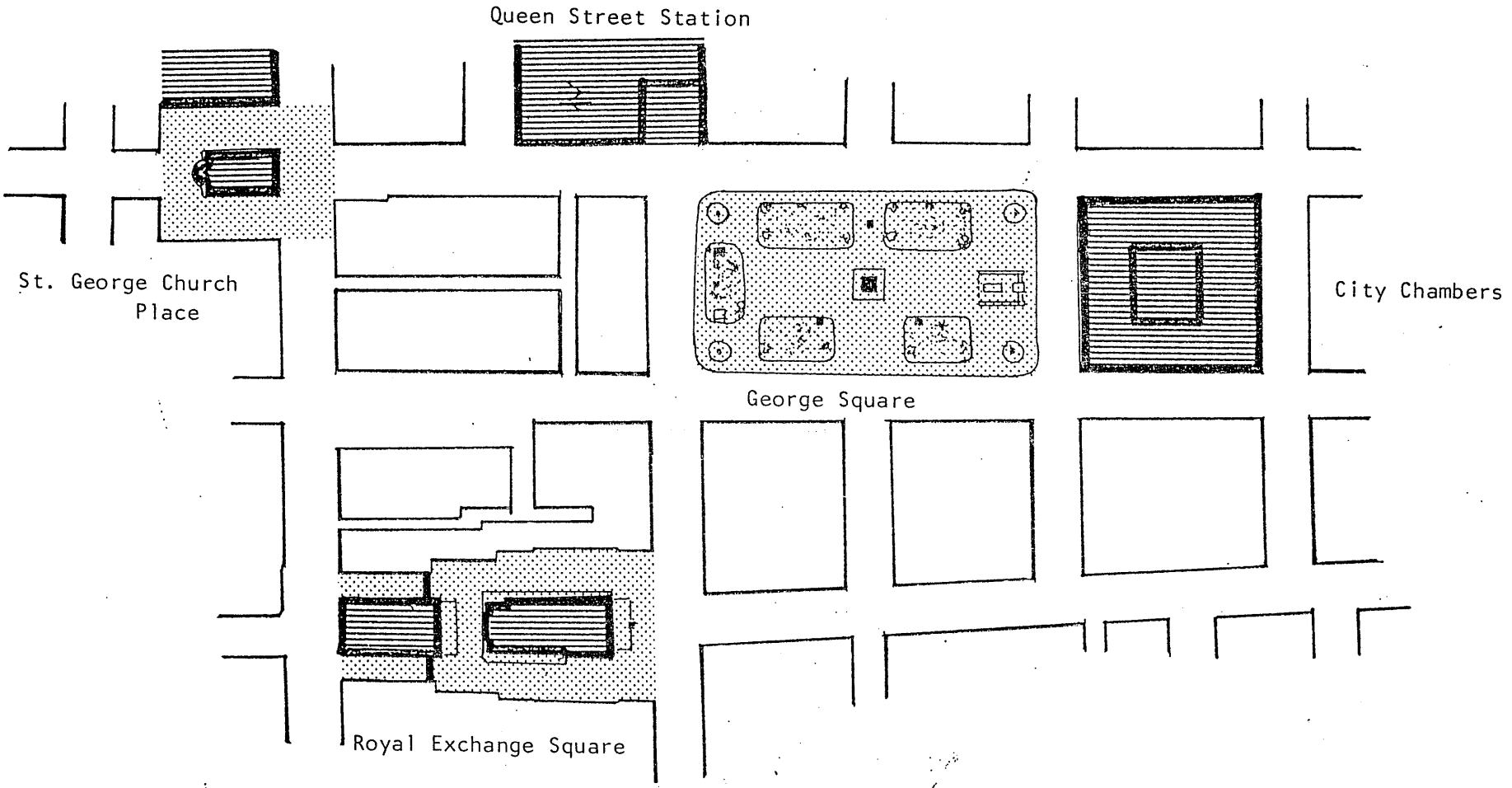


Fig. 4 : Glasgow Civic Centre: Existing Situation

Scale 1:2500

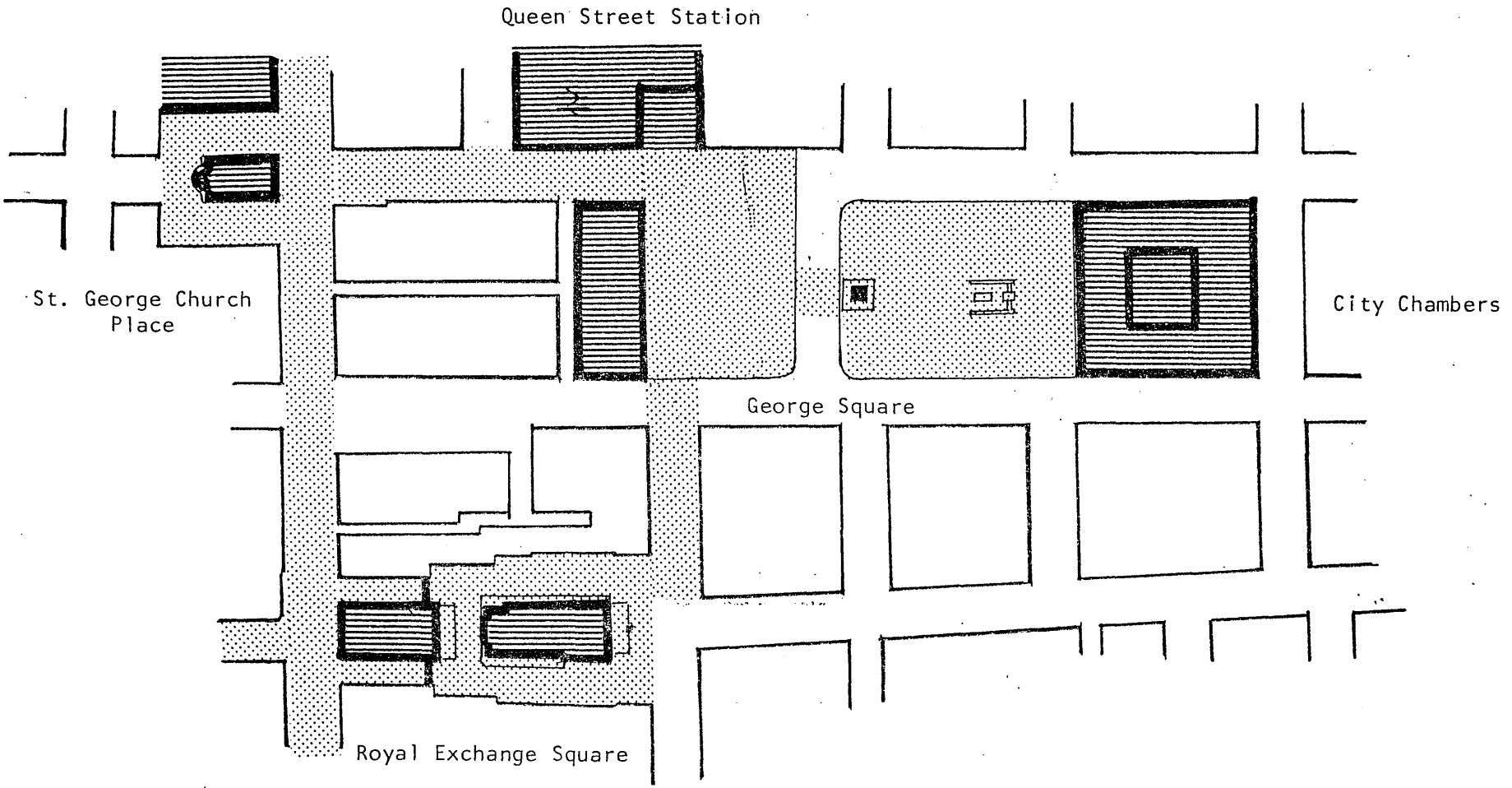


Fig. 5 : Glasgow Civic Centre: Proposal

Scale 1:2500

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CONCLUSION

The grid today cannot be discounted as an urban design tool simply because of a few limited disadvantages. It is not valid argument to put an end to this urban regulator which has long tradition in the art of city's design. Historical development shows how the grid has been relevant to the development of external space which could contrepoint its disadvantages in urban design and servicing.

On the one hand, the grid is still relevant as space control development due to its abilities to allow growth and change. By simple and logical framework, it allows easy and rapid development for both new situations and the expansion of existing cities. By division to give multiples, it allows an equality in landsub-division and public accessibility. These two advantages make the grid a very significant urban and planning tool for development especially in America and countries under new urban development.

In a country like Algeria, the grid can be a very useful tool to provide framework for new situation development and expansion of existing cities:

- In the North, where urban growth in the largest cities has reached its climax, new developments are required to accommodate growth, to put down pressures and to improve urban life. This can be done by developing new settlements in the region of the

High Plateau which represents a vital link between the North and the South of the country and constitutes a gap in the national development.

- Smaller cities, which experience nowadays, dramatic growth resulted from rural exodus, need extension which should be controlled and planned to save cities from becoming congested and slums.

On the other hand, the grid has been misexplored and misinterpreted in terms of urban design and servicing. Therefore resulted its weaknesses which can be resumed in three points:

It gives monotony and lacks vistas and focal points.

It gives no hierarchy of transportation and public open spaces.

It disregards topography and natural features.

The relevance of the grid today as an aesthetic device and means of servicing depends on the grid's size and combination with other special urban events.

The concept of a grid within a grid is to be found to establish transportation hierarchy and to achieve traffic efficiency.

The fast grid with greater distance between controls is to be reserved for fast through traffic.

The slow grid with shorter distance between controls is to be reserved to slow traffic. It allows:

- more accessibility and open public spaces
- short distance for pedestrians
- small plots from which results interesting plotwidth giving rhythm and variety.

However, by this concept, hierarchy and high urban qualities can be achieved.

On the whole layout, special urban events can be combined with the grid as contrepoint to the rigidity resulted from the repetitive grid module. Cerda's plan for Barcelona and Burnham's plan for Chicago are amongst the best attempts to create dynamism, actisism and variety in the townscape by means of vistas, focal points and major public space with special character connected by distinguished network of diagonals and boulevards. This network offers high urban townscape as well as hierarchy. Corners of blocks situated in triangular form sites resulted from diagonals, should be given special attention by treating them as special events with special character.

The relevance of the grid today can be supported by taking into account geographical factors which dictate orientation of its street lines and blocks. In cold climates, orientation should be East-West to have maximum sunlight in the street. In hot climates, orientation should be North-South to have shade in the street and to create micro-climate.

The increase in public awareness and the growing pressure brought about by concern for urban public space and quality, and urban planning legislation and theory has led to renewed interest in the grid development based upon the urban grid, should satisfy public inspiration and create environments of high visual qualities.

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